Electrical World and Engineer

THE CONSOLIDATION OF "THE ELECTRICAL WORLD" AND "ELECTRICAL ENGINEER."

VOL. XLVI. NEW YORK, SATURDAY, AUGUST 19, 1905. No. 8.

PUBLISHED WEEKLY BY THE

McGraw Publishing Company

114 LIBERTY STREET, NEW YORK.

TELEPHONE CALL: 7605 CORTLANDT. CABLE ADDRESS: ELECTRICAL, NEW YORK.

EDITED BY T. C. MARTIN AND W. D. WEAVER.

CHICAGO OFFICE.....1139 Monadnock Block
PHILADELPHIA OFFICE.....929 Chestnut Street
CLEVELAND OFFICE.....402 Cuyahoga Building
EUROPEAN OFFICE.....Hastings House, Norfolk St., Strand, London, Eng.

TERMS OF SUBSCRIPTION

United States, Canada, Cuba or Mexico.....Per year, $3.00
Foreign Countries, within the Postal Union.....$6.00
Great Britain and Ireland.....25 shillings
Germany.....25 marks
France.....31 francs
Single copies.....10 cents

Remittances for foreign subscriptions may be made through our European office. Requests for changes of address should be made one week in advance, giving old as well as new address. No copies are kept on sale beyond fifteen months from date of issue except in bound volumes.

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Entered as second-class mail matter at the New York Post Office.

NOTICE TO ADVERTISERS.

Changes of advertising copy should reach this office by 10 a. m. Monday preceding date of issue. New advertisements will be accepted up to noon of Tuesday for the paper dated the following Saturday.

***The exact circulation of the Electrical World and Engineer each week is stated in this column. Of this issue* 13,000 *copies are printed. Total circulation for* 1905 *to date,* 458,000.**

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TRAFFIC IN GREAT CITIES.

The balance sheet of the Interborough system of New York shows very clearly how essential an element the Subway already is among the transportation facilities of the city. Together the elevated roads and the Subway earned $14,000,000 in the year, with expenses of $6,000,000. The Subway division for the June quarter earned $1,349,871, and from October 27 to June 30, no less than $3,638,987, with expenses of $1,850,358. This is a striking demonstration of the ability of electricity to reclaim lost travel and develop new, for under the steam regime the Manhattan Elevated was really a losing game, and yet the population of the city was yearly in worse plight as to transportation. Large as these earnings are, they will soon be much larger, for the travel on the Manhattan Elevated will grow and the Subway has only begun to touch the possibilities, although on many trains the sign of "standing room only" might well be hung up.

"S. R. O.", as theatrical managers know it, is, indeed, the chronic condition of traveling facilities in great cities; and while the metropolitan street cars have been neglected a bit for the Subway, they, too, will soon be as crowded as of old. In London the same problems confront, as well as in Paris and Berlin, and the report of the Royal Commission on London Traffic—noted elsewhere—finds its echo in all the big urban centers. There is an abundance of work yet left in them for the electric car to do, whether on the surface, overhead, underground and underwater. The newer subways in New York or across it will hardly be ready any too soon for the floods of travel that will rush through them.

ELECTRIC AUTOMOBILES.

In a recent issue we commented on the progress made in electric heating apparatus and urged upon central station managers the desirability of greater interest being taken by them in the subject. Aside from the steady improvement in such apparatus, the fact that there is an equally steady reduction in the price of current, should make it a matter of duty on the part of every central station manager to acquaint himself personally with the merits of the devices. In smaller communities there is a business to be done in selling flatirons, stoves, chafing dishes, curlers, griddles, etc.; and in all places, large and small, there is the possibility of building up a new demand for current. If we are to believe, as we do, the accounts given by some manufacturers of heating apparatus, the indifference displayed by some local lighting concerns is nothing short of extraordinary. This may be attributable, perhaps, to the lingering idea that the apparatus is expensive and unreliable, and that the cost of operation puts it beyond the reach of the ordinary consumer. It is needless to say that the special instances in which electric heat has the advantage over other methods are already very numerous and increase in variety daily. It would seem that there is in store an adequate reward for each lighting company which will systematically endeavor to introduce the heating devices by lending to possible buyers such apparatus as may be connected directly to the lamp sockets and requires no additional house wiring. The most convincing argument to the customer is to be found in the willingness of the company to allow a free trial. In the majority of instances the convenience of the device will prove the determining factor, the cost of the power being given but small consideration.

These remarks apply very directly also to electric automobiles, and to those of the industrial and the pleasure types alike. We fancy that a great many people in the electrical field have no idea of what is doing in this branch of the industry or imagine that the present predominance of the gasoline vehicle is permanent and puts the electric forever beyond consideration. Now there is absolutely no warrant at all for any pessimism in regard to electric automobiles, and no reason for "getting cold feet," as the slang goes. While the electric type may not yet have arrived fully, it sees steady improvement, and all the arguments in its favor become stronger as years go by. Mr. Edison has lately made some announcements as to his battery that are most encouraging, and he does not take back a word of any previous utterances as to his faith in the ultimate supremacy of the electric automobile. But even if the Edison battery never became so thorouhly available as its persistent inventor imagines it will, there will still be advances made and progress to be recorded. As matters stand, our opinion is that the electric, size for size and work for work, is quite as cheap and enduring as the gasoline. Perhaps the "sticking point" as to electrics is the high price of the batteries, but here we look for a lower range as the quantity of production increases and things become standardized. Current will also be cheaper and daily becomes more so, while on the other hand we can see no promise in the future for cheaper gasoline, but on the contrary look for a steady raising of the price.

We doubt whether twenty-five per cent of the central station managers in this country have ever yet taken enough interest in electric automobiles to get one, either for pleasure or for business. As a matter of business, there is a lot of work an auto can do around a station as a patrol, in handling lamps and supplies, and in various other ways; and we are almost inclined to go so far as to say that there is hardly one of the four thousand local companies that would not find it worth while to make the investment in such a machine. They would be encouraging their own industry, learning something about the subject, and setting a good example to many possible customers.

Municipalism in Great Britain.

We have referred a number of times to the growing uneasiness of Great Britain on the subject of municipal trading, which recently has there become a matter occupying general public attention to a very marked degree. Indeed, to combat what has been termed the evil of municipal speculation, an "Industrial Freedom League" has been instituted and has organized a propaganda to curb its course. One of our London contemporaries says in a recent issue that merchants, manufacturers and shopkeepers are actually at present feeling the pinch of high taxes resulting from the prodigal expenditures by local authorities, and at the same time the working classes, who were cheated in the hope of municipal employment at fancy rates of wages, are finding it increasingly difficult to obtain any kind of employment. It adds that it is practically the unanimous opinion of the managers of England's industry that unsound municipal speculation is threatening the foundation of national prosperity. The situation in Great Britain with respect to the municipalization of public utilities is one deserving the most careful attention on the part of those who follow the municipal movement in this country or are affected by its course. The rapidly growing opposition to municipalism in Great Britain is based upon economic grounds, no charge being made that municipal plants give rise to graft, and in most cases it appears to be admitted that such plants are well conducted. The situation now under such earnest discussion in Great Britain would, if municipalism were as widespread in this country, be enormously intensified by the presence of the political factor with all of its possibilities of graft and mismanagement. When such an ardent believer in municipal trading as Mr. Dalrymple, of Glasgow, becomes convinced that these latter considerations render it impracticable for American municipalities to follow in the footsteps of British cities, it is certainly time for us to realize the gravity of the situation presented by the present agitation for municipal ownership, which has recently been so greatly forwarded by the example of Chicago with respect to electric traction and by that of New York through authorizing a municipal street lighting plant.

A Study of the Nernst Lamp.

As is well known, the predominating characteristic of the glower of the Nernst lamp resides in the fact that the glower is a good insulator when cold and becomes a good conductor when hot. If such a material is connected across a source of constant e.m.f. and subjected to a gradual increase of temperature, a current flows tending further to increase the temperature. When the temperature exceeds a certain critical limit, the current taken by the material will be of a value such as to increase automatically at an augmented rate, on account of the increase of temperature due to its own presence, and the final result would be the destruction of the glower were not some check applied. Obviously, therefore, when the glower is operated alone on a constant-potential circuit, it is in all respects unstable. It is apparent, however, that by connecting a resistance in series with the glower, the current can be limited to any desired value, and the operation on a constant-potential circuit can be rendered as stable as necessary.

Objections to the use of a resistance of constant ohmage in series with the glower are found in the excessive energy dissipated in the resistance when the glower is operated at a current which produces stability, and in the impossibility of compensating satisfactorily for changes in e.m.f. Consideration of these facts has led to the use in series with the glower of an iron wire which possesses the desirable characteristic of increasing in resistance at an augmented rate with increase of temperature. Evidently the problem of selecting the proper value of resistance for each glower and of so arranging both the glower and the ballast resistance that each operates under the most advantageous conditions, is one requiring considerable study. An interesting outline of such a study is to be found in an article by Mr. Lewis A. Terven on page 305 of this issue. One of the most detrimental conditions to which a lamp can be subjected is a fluctuation in the supply voltage. It is worthy of note that with the combination used in the Nernst lamp an increase in e.m.f. of supply circuit may result in an actual decrease in voltage across the glower, due to the excess of drop across the ballast resistance with the increase in current through the lamp.

Electromagnetic Waves in Wireless Telegraphy.

Prof. Fleming's second "Tyndall" lecture on "Electromagnetic Waves," delivered recently in London, was reported in abstract and contains a number of statements bearing upon wireless telegraphy at this date. The Poldhu Marconi station is stated to have an aerial consisting of nearly 400 wires, forming an inverted cone, suspended from a framing 200 ft. high. Messages from Poldhu have been received westward across the Atlantic and southeastward as far as Malta and Southern Italy. In describing the various forms of receiving instruments or detectors used, an incandescent lamp of special form is one recently developed by Prof. Fleming himself. It is well known that an ordinary incandescent lamp, when glowing, develops a tendency to throw off particles of matter from the cathode. If a small plate electrode be inserted in the lamp chamber a current of electricity can be taken from the electrode due to the

bombardment of electrified particles from the cathode. By placing such an electroded lamp in a local receiving circuit connected inductively with the air wire the oscillating impulses from the air wire produce unidirectional impulses of current between the cathode and electrode. The presence of these unidirectional impulses can be detected on an ordinary galvanometer. It would seem as if the same rectification should be capable of being effected by a mercury vapor lamp.

An instrument called a cymometer, for measuring the length of the wave emitted by an air wire, was exhibited. It consisted of a local oscillation circuit having adjustable inductance and capacity, with a neon vacuum tube across the terminals. A neon tube is particularly sensitive to alternating e.m.f. and glows visibly at the relatively low e.m.f. of from 300 to 400 volts. By this means it is stated that the length of a 300-meter wave can be measured to 1 per cent. In the case exhibited at the lecture there were two adjustments of the circuit at which the neon tube lighted up, one corresponding to a wave length of 1,300 ft. and the other to a wave length of 900 ft., showing the coexistence of both series of oscillations. It is well known that when a primary oscillating circuit is magnetically linked with a secondary, two rates of oscillations will, in general, be set up in both. Another cymometer exhibited consisted of an ebonite rod 6 ft. long wound with 10,000 turns of fine wire. A grounded traveling contact permitted this solenoid to be tuned to the aerial. The neon tube held opposite to the solenoid indicated the presence of stationary waves of e.m.f. By laboratory measurements the speed of wave transmission along the solenoid was about 200 times slower than that of light, or roughly 1,000 miles per second. The solenoid cymometer was stated to be less well adapted for wave length measurement than the local oscillation circuit; for the latter could be removed from metallic connection with the tested aerial, while the former could only be used in such close connection as to affect the electric condition of the aerial appreciably.

It was pointed out that a common length of wave for signaling at sea was about 100 meters, corresponding to a frequency of three millions per second. This would not do, however, for land service, as houses were not transparent to such short waves, but were very fairly transparent to waves of 1,000 ft., or say, 300 meters, corresponding to a frequency of one million per second. From this it would seem likely that walls of brick and stone are opaque to all frequencies of light from three millions up to eight hundred trillions per second, or more, the latter being the frequency near the violet end of the spectrum. It should be possible before long to determine the actual attenuation of waves of different frequencies over long distances of land and sea. It is reasonable to expect considerable differences in the attenuations of waves of different lengths even over a smooth ocean, owing to differences in absorption into the water below, or into the air above.

THE SIZE OF GENERATING UNITS.

Recent developments in steam turbine and steam engine practice have made a profound change in the situation with respect to the size of the units employed. In the earlier direct-connected sets there was a very considerable difference between half-load and full-load efficiency, so great that it must be made the chief factor in planning the station. Of course, going back to the old-belted stations, this condition existed in the most aggravated form, but we are referring to days later than those. The steam turbine, of course, with its very light friction is nearly as economical at half load as at full load, and it is therefore a matter of small consequence whether it is worked close to full load or not. The same is the case with respect to reciprocating engines which are properly designed for the purpose, quite contrary to the popular belief on the subject. It has therefore become a fact that in an electric generating station of really modern design there need be no subdivision of units for the purpose of adjusting their number to the requirements of partial load. There is, of course, a species of irreducible minimum below which the number of units cannot be brought, but this depends to-day merely upon the question of safety in operation and not upon light-load requirements. To our minds this change of conditions is one of the most important and interesting of recent years.

One is never safe in planning a station with so few units that the disabling of one of them will cripple the output. This means practically that $(n-1)$ machines must aggregate enough of unused overload capacity to equal one unit. As the present tendency is to rate generators fairly high—in other words, to cheapen them per kilowatt of rated output—there is small danger of getting dangerously few units. Ordinarily about four would constitute a minimum for economical working, assuming that there is no machine really held in reserve. Now and then three or five might be advisable, but seldom fewer or more so far as mere security against breakdown is concerned. Now with three or four modern direct-coupled units, any ordinary distribution of load can perfectly well be taken care of without at any time getting away from the economical range of the machines. For instance, with three units, worked as usual with a slight overload at the peak, station loads down to 12 or 15 per cent of the peak can be dealt with without ever running a unit below half its rated load. With four units, there is a still wider range, and the upshot of the matter is that with a station designed with proper reserve against breakdown, the question of partial load may practically be neglected, assuming that the units are interchangeable. If a station of, say, 12,000-kw capacity is built with, say, four 3,000-kw units, it will probably turn out its total energy more cheaply than if it were equipped with eight 1,500-kw units. The cost of the former arrangement would be so much less than that of the latter in machinery, switchboard and foundations as to more than offset any difference in light-load efficiency.

In fact, in this hypothetical case the loss in light load efficiency by using the larger units would probably be almost negligible in a well-managed plant. This improved situation in plant design has come about not only by improvement in the light load working of the prime-movers, but by the improved methods of distribution which have rendered one class of units applicable to all classes of work. These, to be sure, have not yet been utilized to the fullest extent, so that a good many crude methods are still in use; but the fact that thoroughly first-class service can be given to-day with but a single type of generator in the power house, and that in large units, over a distributing system free of all intermediaries is one that speaks volumes for the progress in the last decade. Even so little as ten years ago the interior of a new generating plant looked more like a machine shop than a power station. If indeed the plant were not a maze of belts it was certainly lumbered up with half a dozen sizes and kinds of machines, destined to be scraped within the next few years. To-day there is a reasonable prospect that the large direct-connected generators now installed may not have to be discarded for a much longer period, although we venture to predict that some of the installations made within five years will be obsolete much sooner than the owners think. At least the station to-day can be relatively simple and efficient, of few and large units easily cared for—the fewer and larger the better within the limits of security in operation. The weakest point of central station working to-day is the complicated and fussy distribution system generally remaining as the heritage of partial reconstructions and reorganizations.

The Franklin Celebration.

In regard to the proposed celebration next year of the two hundredth anniversary of the birth of Franklin, Mr. Barr Ferree, secretary of the Pennsylvania Society of New York, writes:

Franklin was a many sided man, whose talents were developed in what was then the metropolis of America, Philadelphia. Most of the interests with which he was concerned are to-day represented by important organizations having headquarters in New York. It is fitting, therefore, that this metropolitan city should adequately commemorate the 200th birthday of one of the greatest of Americans, a man whose interests were so varied and so highly developed, and who did so much for his country both at home and abroad.

Pennsylvania is proud to claim this distinguished man as her greatest son; for while born in Boston, he reached maturity in Pennsylvania, and as a Pennsylvanian rendered his most notable services to his country. The Pennsylvania Society has therefore proposed to a number of learned, literary and scientific societies in this city a plan for a joint Franklin commemoration, in which all these organizations would be equally interested, and which would thus represent Franklin's own interests in a very complete way.

This plan has already received hearty expression of approval from most of the organizations before which it was brought, and while no definite programme has yet been determined upon, the outlook for a suitable commemoration of the Franklin bicentennial on January 17 next seems excellent. The plans under discussion at present involve a general memorial meeting, with exhibitions of Franklin books, portraits and other relics.

A preliminary meeting of representatives of a number of interested organizations has already been held, and a very great deal of interest manifested in the proposal. The co-operation of all bodies which might be interested in this anniversary is earnestly solicited.

Statistics of Street Railway Development.

The annual statistics of street railway development in the United States and Canada are given this month by the *Street Railway Journal* in the usual valuable table, which constitutes a document of very interesting character. The grand totals for the United States showed 993 roads or systems, with 30,187 miles of track, 75,904 cars, and capital obligations of $3,217,091,971. The table divides the country into five territorial groups. The Central States have the most electric track mileage and the Southern States the least. Of the individual States, Ohio leads, with 3,181 miles; New York is second, with 3,175, and Pennsylvania, with 3,142, is third. Each of these States has more electric mileage than the aggregate of the entire Western group of 17 States and Territories. Except for California none of this Western group has as much as 350 miles, and only seven of the 17 have as much as 100 miles. Every State and Territory is now represented, although in 1903 South Dakota, Nevada and New Mexico had no electric mileage. South Dakota had only four miles in 1904, and Nevada five miles. The nine Central States have over seven times as much mileage as the nine Southern States. Not less than 97 per cent was worked by electricity in 1904, the chief instances of horse, cable or dummy lines being in New York, Chicago and San Francisco. The average capitalization, total of stocks and bonds, per mile of track throughout the country, was $108,876; the average capitalization in Massachusetts was $49,158.

The capital liabilities were constituted by stock and bonds or funded debts, the stock amounting to $1,761,571,812, or an increase for the year of $68,181,514. The funded debt amounted to $1,455,520,159, or an increase of $66,055,810. The total increase in capital liabilities for the year was $134,839,324, while the cars had increased 1,606 and the track mileage had grown 1,731 miles.

The figures for Canada are also interesting. The cars numbered in 1904 were 2,639, a gain of 135, and the track mileage was 900, as compared with 920 in 1903, the change being due apparently to previous duplication. The total capital obligations were $69,404,192, a gain for the year of $10,055,554. The funded debt was $28,571,050, a gain of $3,423,492, and the capital stock was $40,833,142, a gain of $6,632,062.

The insular possessions of the United States reported six systems, 81 miles of track, 188 cars, $3,181,500 of capital stock, $1,930,000 of funded debt, and a total capital obligation of $5,111,500. Cuba made a good showing with two systems, 55 miles of track, 160 cars, capital stock of $13,500,000, funded debt of $8,550,000, or total capital obligations of $22,050,000.

As already noted above, the adoption of electricity is going on apace, and is already so far advanced that it stands for 97 per cent of the industry in round figures. Moreover, these statistics for the first time group steam, horse and cable under one head, it being no longer useful or worth while to treat these items separately. The increase of electric track mileage was from 27,754 to 29,548 in 1904; of motor cars from 58,141 to 59,625, of trail cars from 5,868 to 6,900, and of service cars from 4,214 to 5,475.

Municipal Ownership in a German City.

It had been supposed that Glasgow headed the list of cities with a multiplicity of municipal enterprises, but Freiburg, Germany, runs it a close second. The following is a little list of some things it does for a population apparently incapable of doing much for itself:

1. Four hundred cottages, each with a little garden. Over $370,000 has been spent by the city to give the poorer citizens better homes.

2. Electric street cars. The fare to any part of the city is 2½ cents.

3. Fifty advertising boards. All outdoor advertising is controlled by the city. The rate is 10 cents a day per square foot.

4. Pawnshops. The city owns all the pawnshops and charges a low rate of interest. It does not try to make any profit, but runs the pawnshops at cost.

5. Savings bank. The city owns the only savings bank in Freiburg. It has over $5,000,000 in deposits.

6. Theatre. The principal theatre at Freiburg is owned by the city. The citizens regard the theatre as part of their educational system.

7. Restaurant. There are public restaurants in Freiburg which serve breakfasts and suppers for 5 cents and dinners for 6½ cents. The citizen can get a good cup of coffee and two thick slices of bread for 2½ cents.

8. Burial of the dead. The city has taken over the undertaking business. The cost of a funeral in Freiburg runs from $5 to $32.

9. Farms and forests. The city has bought large tracts of land near the city, so that work may be given to any workmen who need open-air jobs for their health.

10. Correct time. A $5,000 electric clock has been placed in the City Hall. This clock connects with eighty-five other clocks in different parts of the city.

11. Electric light. The city manufactures all its own electricity, both for light and power.

12. Architects. Freiburg pays a salary to the best architect in the city as a kind of building department.

Electrical Development in Connecticut.

The following review is made of the recent developments in Connecticut of plans for light and power: An examination of the laws enacted during the recent session of the General Assembly shows a considerable body of legislation concerning gas and electric companies. Several lighting and power corporations were created. The Uncas Power Company, of Norwich, which has an authorized capital stock of $1,000,000, and which is granted large powers, was incorporated. The Glastonbury Power Company was chartered to manufacture and sell electricity in several towns; to erect a dam on Roaring Brook, and to construct a street railway from Glastonbury to Manchester. Its authorized capitalization ranges from a minimum of $350,000 to a maximum of $800,000. The Rocky River Power Company, of New Milford, received a franchise to manufacture and sell electricity for lighting and power purposes in specified areas of Litchfield and Fairfield Counties, and to construct a dam and storage reservoirs on Rocky River. It is empowered to issue capital stock up to $500,000. Another incorporation is the Sterling Power Company, which is authorized to manufacture and distribute electric power and light in the towns of Sterling, Plainfield, Killingly and Brooklyn. Its maximum capital stock is $500,000. The Northern Connecticut Power Company, of New Hartford, which has rights to operate in Litchfield, Hartford and Tolland Counties under certain restrictions, and which is to develop water power on the Farmington River, and also the North Haven Gas & Power Company,

which has a charter to supply electric light and power to Durham and a part of North Haven, are additional corporations which were created by the Legislature.

The charters of several companies were amended with respect to bonds and capital stock. The New Milford Power Company, of New Milford, which has a thirty-years' contract to supply electricity to the Connecticut Railway & Lighting Company for traction and illuminating purposes, was authorized to issue $2,000,000 bonds. Of this $1,000,000 is to be used for refunding. The company is also authorized to absorb any other electric light, power or street railway company, or to merge with any such corporation. The Derby Gas Company, of Derby, was empowered to increase its capital stock from $400,000 to $1,000,000. The Seymour Electric Light Company was authorized to increase its capitalization by an amount equivalent to three-fourths of its capital stock.

A summary of the miscellaneous legislation affecting lighting and power companies is as follows: Authorizing the Putnam Light & Power Company to engage in business in Pomfret; authorizing the People's Light & Power Company, of Danielson, to extend its business into Brooklyn; authorizing the Litchfield Electric Light & Power Company to operate in Washington; authorizing the Branford Lighting & Water Company to extend into East Haven; extending until July 1, 1907, the time for perfecting the organization of the Newtown Electric Light & Power Company; authorizing the Eastern Connecticut Power Company to purchase any existing electric company in New London and Windham Counties outside the city of Norwich; authorizing the Torrington Electric Light Company to extend its lines into Goshen; authorizing the Sharon Electric Light Company to operate in North Canaan and parts of Salisbury, and authorizing the Burkshire Power Company to erect a dam at the toll bridge in North Canaan and to acquire land to flood for reservoir purposes.

The French Cable in Venezuela.

As noted recently in these columns, the Federal Court of Cassation of Venezuela has annulled the contract of the French cable system—the Compagnie Francaise des Cables Telegraphiques. The decision has attracted considerable attention, and several interviews have appeared on the subject. The Caracas correspondent of the *New York Herald* says: I have had an interview with M. Desiré Brun, representative of the French Cable Company here, in regard to the judgment. He said: "The final judgment of the Court of Cassation establishes nothing new. You must notice that the attorney general, Senor Parejo, has not presented any brief either before or after the reception of the brief of M. Planchart, although the latter appealed from the judgment of March 31. The judgment of August 4 proves that by a system of partial quotation the documents presented by the company were made to give a contrary meaning, qualifying the concessions on the part of the company. Therefore, as no appeal was admitted, the company considers itself the victim of demagogue justice and will appeal to the French government to defend and sustain the present situation, obtained at great cost. The company has protested to the French Legation, and, not recognizing the judgment, continues fulfilling the terms of the contract. Intervention is not expected by the company until it is molested in its rights. It will oppose any attempt to interfere with its privileges."

The government will leave the company undisturbed, it is believed, until the arrangement of the new concession. It is considering granting a new wireless concession from Macareo to Trinidad. Possibly this will be a government moponoly. The officials are already experimenting.

M. Wiener, the French minister, negotiated an arrangement with the government in April on condition of the withdrawal of the suits against the company, ceding the coast cables to Venezuela, promising the establishment of direct cable communication, the removal of the office from Caracas to La Guayra and reduction in the tariff. The company did not accept this scheme, asserting that M. Wiener had abandoned their interests. Señor Madueno is now in Paris trying to convince the government by means of alleged documents of the complicity of the company in the revolution, that it is not worthy of the support of France and that it had posed as a victim while aiding Matos.

An interview that appears to throw some light on the situation is one with M. Sauvage-Monet, who remarks:

"Having belonged to the company nine years, I have never lost interest in its work. I think—and in this I am in accord with numerous specialists and politicians—that the French company has lacked progressive management.

"The whole secret of the non-success in France of an industry in which the English, North Americans and Germans prosper consists in the fact that since its foundation the French company has had heads of bureaus who have not been prepared, either by their studies or by their preliminary work, to carry on this delicate enterprise. The result is that these people see in the work only the financial end and neglect the technical part, of which they are besides, totally ignorant. Founded in 1888, the company every year has had difficult balance sheets.

"Having in general badly chosen their points to be dealt with (except Venezuela, Brazil and Hayti), the places where the company's lines touch do not return enough receipts to cover expenses, neglecting, moreover, points which could be a good source of revenue—(Belen, Brazil, brings to the Western Brazilian Company $600 a day, and the French company has there a cable which it has allowed to be interrupted since 1901)—heads of bureaus in the Avenue de l'Opéra busied themselves about petty details of the affair, and every year saw the enterprise decline.

"In the political troubles which agitate the greater part of the countries where they had installed their service these heads of bureaus saw only the temporary increase in the number of telegrams, and, as on the other hand the service of the company had caused the discontent of the governments of all the countries where they were established, these heads of bureaus came little by little to see in revolutions only opportunities of fishing in troubled water. That is what happened in the Matos revolution in 1902-1903."

It will be remembered that the government of Venezuela is punishing the company for alleged participation in political intrigues and revolutions.

The Advance of the Rural Telephone.

It is safe to say that no other agency has influenced country life in America to the extent that the telephone has in the past five or six years. During this period many thousands of instruments have been placed in service by both the Bell and the independent companies, and it would be impossible to estimate the amount of time and money which the farmers of this country have been saved by the rural telephone systems, from the fence post lines to the manually-operated exchanges of the more populous communities. It is a mistake to suppose, however, that the field has been so well covered that little remains to be done to bring home to the farmer the incomparable advantages of the telephone as a labor-saving device. A vast number of rural homesteads are still without telephone service, and although the time is far distant when the cost of telephone service will bring it within the means of every farmer, it is certain that many tillers of the soil are to-day losing money through the lack of telephones in their homes. The influence of the trolley has been very great in its reduction of rural isolation, but in the natural course of events every farm cannot border a cross-country street railway or interurban line, and even short journeys consume valuable time.

On most American farms there are only about 200 good working days per year, and the loss of a single day in the busy season may readily damage a crop to the extent of $20 or more. In case farm machinery breaks down or stock falls ill the lost time involved in a trip to the nearest town for spare parts or a veterinarian is a serious matter when the cornfield is weedy or the wheatfield ripe. Arrangements for additional labor, market quotations, news of the world, social conversations, calls for help in case of illness, fire or accident, orders of provisions and supplies—these and many other uses render the telephone simply invaluable on the modern farm. It will pay for itself many times over in the course of a year on any farm which is worked for profit. Even the ancient birthplace of John Greenleaf Whittier in Haverhill, Mass., is equipped with a telephone for convenient use in preparing for parties of visitors. The contrast the telephone offers to the antique fireplace, furniture and fittings of this isolated farmhouse is a significant mark of the scientific progress of the last century.

Prof. Darwin on Radium.

A special cable dispatch from the Cape of Good Hope reports as follows the opening of the British Association meeting there on August 15: "At their first session to-night Prof. George Howard Darwin, of Cambridge, the president of the association, delivered an address in which he recounted some recent experiments with radium which supports a theory of transmutation of elements. The results, he declared, seemed in absolute contradiction to all that was known until recently about the elements in the make-up of the universe.

"Within the last few years, he said, electrical researches had shown that the atom was not indivisible, and a flood of light had been thrown thereby on the ultimate constitution of matter. By various convergent lines of experiment it had been proved that the simplest of all atoms—that of hydrogen—consisted of about 800 separate parts, while the number of parts in the atom of the denser metals must be counted by tens of thousands. These separate parts of the atom had been called corpuscles or electrons, and might be described as particles of negative electricity." He then said: "Although the conception of the decay of an element and its spontaneous transmutation into another element would have seemed absolutely repugnant to the chemist until recently, yet analogy with other moving systems seems to suggest that the elements are not eternal. Thomson conceived that an atom might be constructed after a model he had devised—an electrical miniature planetary system which was a triumph of mathematical power—that he thought might be made to run for a million years, but it would not be eternal. Such a conclusion is an absolute contradiction to all that was known of the elements until recently, for no symptoms of decay were perceived, and the elements existing in the solar system must already have lasted for millions of years. Nevertheless, there is good reason to believe that in radium, and in other elements possessing very complex atoms, a break up and spontaneous rearrangement which constitutes a transmutation of elements is actually observed."

It was impossible to say how science would solve the difficulty, he concluded, but future discovery in this field must prove deeply interesting.

Electricity in the Mining of Marble.

The application of machinery to the mining of marble is quite modern, American and electrical. In Vermont alone it is estimated that more than $5,000,000 is invested in quarry machinery and other equipment, a large portion of which is electrical. The latest adaptation of power and machinery to the marble industry is the result of changing conditions. The Lynn (Mass.) *Item* gives some very interesting details on the subject. When such extensive marble deposits as those at Rutland, Vt., were first opened, the range of work was kept within a narrow field, and a single steam plant would often serve to operate derricks, drills and channeling machines. Steam was conducted through pipes to the different machines, and air compressors were driven by the same power at the various places where pneumatic tools were employed. So long as the quarries were of moderate size, the hand and steam derricks, drills and locomotive cranes were sufficient to answer all purposes. But the business rapidly assumed such proportions as to make a change of power distribution necessary, and some of these quarries have already reached such dimensions that steam power distribution has grown unwieldy and costly, and naturally electricity was looked to as a means of lessening the cost. The great quarries are steadily displacing the old-fashioned methods with electric motors. Owing to the tremendous size and weight of some of the blocks of marble that are now cut and dressed for shipment, such as for obelisks, mausoleums, statuary groups and so on, the derricks and cranes are the most important machines, and modern powerful electric gantry cranes have been installed.

At Proctor there is a five-motor, electric traveling gantry crane which displaced ten of the old steam power derricks. This crane operated by one man saves as much in labor as it does in efficiency. This particular gantry travels 800 ft., but the distance can be increased indefinitely as the quarry extends. Its maximum capacity is 50 tons, and the blocks can be raised nearly 40 ft. if necessary. The crane is used chiefly for loading cars, the trains passing directly under the crane, and as the bridge upon which the crane travels is 160 ft. in length, it has a wide field of operation. Portable locomotive cranes are further making the boom derrick unprofitable; they can travel from one part of the quarry to another, and load blocks directly from the beds to the cars.

It has only been within the last year or two that electric channeling machines were used, but they have given so much satisfaction that their use is steadily increasing. The new type of electric machine cuts on either side of it a channel from four to 10 ft. deep, and less than two inches wide, whereas the steam type of channeling machine cut but one channel at a time. A single electric motor mounted on the new machine and traveling with it operates the cutting implements and also drives the traction gear of the machine. In addition, electrically operated drills, chisels, sand saws, buffers, etc., are also used in the New England quarries, and in fact nearly every practical means of reducing hand work and manual labor is being employed.

Duncan Meter Patents.

The Patent Office budget of August 1 contained 40 patents issued to Mr. Thomas Duncan, of Lafayette, Ind., relating to various types of commercial electrical measuring devices. It will be recalled that about three years ago (April 29, 1902) 57 patents were on the same day issued to Mr. Duncan, mostly on alternating-current meters. The recent patents relate principally to meters for special service, as for use with storage batteries, in connection with prepayment and discount systems, etc. The patents carry consecutive numbers from 796,030 to 796,061.

Three patents, Nos. 796,033-035, are for monetary meters; that is, they indicate upon their dial, the equivalent of the energy consumed in dollars and cents, so as to provide a very easy method of showing to the customer the amount of energy that he has consumed. These patents also show an additional dial which indicates the electrical energy in kilowatt-hours, so that the customer can have readings of the energy in kilowatt-hours, and the equivalent thereof in dollars and cents.

Two patents, Nos. 796,036-037, relate to meters to be used in conjunction with motor service, and by which it is possible to make the users of motors pay a little extra for the abnormal current which they use when starting motors. These inventions are based upon the principle that it is but proper that the users of energy as applied to electric motors, should be required to pay more for the current used in starting the motors, on account of its being such a tax upon the generating capacity of the plant. These two inventions also show an arrangement whereby a predetermined discount can be allowed by the mere setting of a little switch lever on a contact which corresponds to the per cent discount that is to be allowed. This is for the purpose of eliminating the necessity of the bookkeeper having to figure out the bill at the end of the month, with the discount already referred to—the meters doing it automatically.

Two patents, Nos. 796,038-039, are on discount meters, and provide means whereby a predetermined discount may be allowed, the meter taking care of itself, while provision is also made for giving a sliding discount, depending upon the load. For example, if a contract is made to allow a customer a 10 per cent discount from the regular rate, the discount lever is set on the contact marked 10 per cent; then, by means of an electromagnetic arrangement, a further discount will be allowed, depending upon the load that is being used. If the motor is operating at one time on 25 per cent of its capacity, the meter will automatically allow for, say 5 per cent; for operating on one-half load, 10 per cent; and for operating on full load, 15 per cent, or any predetermined percentage that has been decided upon. The object of these meters is to provide an instrument in which a single reading on the dial at the end of the month may be taken, which, when mutiplied by the standard rate will represent the actual amount of the bill, the meter having taken care of all the various discounts for the different loads automatically during its operation.

Patent No. 796,040 shows an ingenious arrangement in an electric meter whereby a dial that reads both in watt-hours and in dollars and cents may be placed at any convenient point on the outside of the building—such as the back porch—so that the monthly readings of the meter can be taken by the meter man without his having to enter the house. This eliminates the difficulty of the meter man having to go to a house a number of times, if perchance,

he does not find the occupants in. It also prevents having to let the reading of a meter lapse for two or three months through the meter man failing to find anyone in the house when he went there for the purpose of taking the reading. This invention also contains provisions whereby a plurality of dials may be used; that is, a second one may be placed in the library or any other place within the house for the occupants to read, instead of having to examine the one on the outside.

Three patents, Nos. 796,041-042 and 796,066, show multi-rate meters, and have for their object the securing of a sliding rate, depending upon the load at the plant; that is, as the load in the evening approaches the highest point, or the peak, these meters automatically increase the rate with the increase in the output of the plant. They are also so organized that they will operate during a certain portion of the day at normal or regular rate, and at other portions of the day will give a discount, whereby the more energy consumed, the cheaper will be the rate. For example, these meters will, from 4 o'clock in the afternoon until midnight, automatically increase the rate by any predetermined amount as the load at the central station increases, and from midnight until 7 o'clock the following morning, they will reduce the rate in a sliding manner as the energy passing through them is increased—the object being to secure as much business as possible between midnight and the following morning when the majority of the customers have no lights in use. From 6 to 7 o'clock in the morning until 4 or 5 in the afternoon, the rate is normal, or that which is ordinarily charged, and without any sliding rates one way or the other.

Twelve patents, Nos. 796,043-044 and 796,049-060 represent many methods of measuring the energy delivered to storage batteries, and also means for measuring the amount of energy that is given out by said batteries in return. Dials are provided to show the amount of energy used in charging, and the amount given out in discharging, and further provisions are provided to indicate when such batteries are fully charged and when empty. In some of these inventions an electromagnetic drag is supplied to the retarding disk, which is made to vary its strength with the change in the e.m.f. of the cells, so that the index will always show correctly when the batteries are ready to be recharged again. The meters of these inventions are particularly applicable to electric vehicle work, enabling the operators of such vehicles to tell readily when to recharge their batteries, and also when they have been sufficiently charged; in addition to this, the meters can also be used by lighting plants for the purpose of ascertaining the exact amount of energy supplied for the purpose of charging the cells during the month. The dials which show the input and output also show the efficiency of the battery, and thus are a good check or means for indicating when batteries are in bad condition. One of the principal aims has been to have the instruments in a compact form, so that one can be supplied to each electric vehicle, and at the end of the month the central station superintendent can send his meter man around to read the meter just as he would a meter installed in a residence. A number of methods are shown whereby the inefficiency of the cells is taken care of, and as per the following example:

If a battery of cells has an efficiency of 70 per cent, then the 30 per cent must be taken care of in the operation of the meter, so that the indicator will show that the battery is ready to be charged again when only 70 per cent of the energy delivered to it has been taken out or expended. One way of doing this is to subject the detarding disk to an electromagnet, the terminals of which are connected in shunt to a portion or all of the battery cells. As the cells become exhausted their e.m.f. becomes less, and consequently, the amount of current that traverses the electromagnet will also become less, the electromagnet thus becoming gradually weaker as the pressure of the cells is gradually lowered; as the pressure at the batteries is gradually reduced, the drag will be correspondingly reduced, so that the meter will have a chance to operate quicker as the pressure falls off. In this way it is very easy to have the meter indicate exactly the exhausted condition of the battery when any predetermined percentage of the energy supplied to it in charging has been taken out. To take care of large amounts of current that may be drawn from the battery, a differential electromagnetic drag system is described, which also tends to reduce still further the drag when heavy amounts of current are required. This is desirable, since the efficiency or output of a battery is reduced when its current discharges beyond a normal point. In addition to employing an electromagnetic means in conjunction with the retarding mechanism of the meters, still other methods are shown for automatically compensating for the loss in the batteries, as by varying the resistance in the armature circuit; this is accomplished by a solenoid in series in the main circuit, and as the current or output of the batteries is increased, the plunger of the solenoid cuts out resistances from the armature circuit so as to permit the armature to speed up as the load is increased.

Three patents, Nos. 796,046-048, represent what may be termed sliding discount meters. In the sale of electrical energy it is common to give a customer a certain rate per kilowatt-hour, providing that he uses a certain amount, but such arrangements have had to be taken care of by the bookkeeper when making out the bill at the end of the month. This represents a great deal of work in the office if a number of customers are using current, each of them, perhaps, enjoying a different discount or rate. To simplify the matter of taking care of such accounts, and at the same time to have the computations done automatically in the meter, these three inventions have been developed. These meters are provided with neat switching mechanisms, which permit the giving of a sliding discount as the amount consumed is increased, as illustrated by the following example:

Suppose a central station makes a contract with a customer, as follows: "We will charge you a rate of 10c. per kilowatt-hour on all energy which you use up to and including 25 kilowatt-hours, and after you have used this amount we will allow you a discount of 10 per cent on the next 25 kilowatt-hours, another discount of 5 per cent on an additional 25 kilowatt-hours, and so on." The arrangement for accomplishing this can take care of 10 sliding discounts, and the mechanism of the meters are also so organized that the relative amounts of energy that is to be discounted can be taken care of. The result is that the meters take care of the plurality of rates and discounts automatically; at the end of the month the meter is simply read in the ordinary manner, and then the product of the reading by the usual or standard rate will represent the amount of the bill for the month, with all the different rates taken care of.

Patent No. 796,062 is for a prepayment meter, which is so constructed that a number of coins can be deposited at one time and full credit given for same. It also has a ringing alarm to operate at any predetermined time before the switching mechanism in the meter is operated; in other words, it can be so set that it will ring an alarm bell 15 or 30 minutes before the lights will become extinguished, or before the last coin has dropped into the cash receiver. This does away with the annoying drawback of having the lights extinguished by prepayment meters without any warning.

Two patents, Nos. 796,063-064, are on automatic storage-battery charging devices designed for the purpose of installing in garages to charge the batteries of automobiles. It is only necessary to connect the terminal plugs of the vehicle battery to the switchboard, which is part of the charging device, and after this the operation is entirely automatic; when the battery is properly charged the switches will be opened, and the battery disconnected from the charging circuit. One of these inventions takes advantage of the pressure of the cells to regulate the time when the charging is to be stopped. A solenoid is provided with a moving pointer which passes over a graduated volt scale, which scale is provided with an adjustable contact placed at a point on the volt scale which will represent the pressure of the cells when charged; as soon as the e.m.f. of the cells becomes high enough, the solenoid core or pointer will touch the scale contact, and thereby open the charging circuit automatically. These inventions also have application in private garages, enabling the owner of the vehicle to simply connect his battery with the charging apparatus; then go off and leave it for the night, the operation of charging being entirely automatic.

Patent No. 796,065 is likewise for a meter employed in the charging of automobile batteries, and indicates when such battery is full, also when empty or ready to be recharged. Provision is also made to take care of the leakage of the cells when the battery is out of commission. It frequently happens that after the battery is fully charged, the owner of the vehicle may not have occasion to use it for a month or so; as he has not used it since it was charged, he would naturally assume that it was all right, while, as a matter of fact, it may have become pretty well exhausted in the interim, and if put in use, as would be done under ordinary circumstances, the plates would probably be damaged. This meter provides means

whereby an indicator will show whether or not the battery is exhausted, and irrespective of whether or not it has become exhausted through long standing or constant use.

Patent No. 796,068 is for a meter in which provision is made to save the armature from the destructive effects of lightning. In the operation of direct-current commutator meters, the lightning destroys quite a number of armatures annually. This invention is devised for the specific purpose of preventing the lightning from entering the armature.

Patent No. 796,069 is also for a direct-current commutator meter, and in which the principal novelty is that of adjustable brushes and polyphedral formation, and has for its object to enable the meter man at central stations to apply a new brush surface to the commutator whenever necessity demands it. The brush tips of meters have heretofore only one contact surface, so to speak, and when this became rough or worn, it either has to be removed from the meter and filed down to a smooth surface, or a new brush substituted; with the polyphedral arrangement a new surface can be brought into contact with the commutator by simply turning the brush around. Some of the other inventions are for indicating ammeters and voltmeters.

The Passenger Traffic Problem in London.

The full report of the Royal Commission on London Traffic is a bulky document, but no larger than might be expected, in view of the magnitude of the questions with which it deals. Its issuance was noted briefly in these columns. We now give below the Commission's own "conclusions," as summarized by it at the end of the report:

It is imperatively necessary, in the interests of public health and public convenience, and for the prompt transaction of business, as well as to render decent housing possible, that the means of locomotion and transport in London and its adjacent districts, should be improved; they are seriously defective, and the demands and needs of the public are annually increasing.

The main obstacle to such improvement is the narrowness of the streets, which were not laid out in accordance with any general plan. The arterial roads leading out of London largely suffer from the same defects. A comprehensive plan for the improvement of streets and main roads should be prepared and carried out continuously, as financial considerations will allow. We have suggested some improvements; many more might be suggested, but the difficulty is one of money, and progress must be gradual.

Increased modern means of locomotion and transport are much needed, both to facilitate movement within the central area, and to facilitate access to and from and within the suburbs for those who work in London and live outside. Electric tramways and railways are necessary for both these purposes; tramways mostly for the former and railways mostly for the latter, with intercommunication between the two.

The tramways system of London is disconnected and insufficient; it should be largely extended, and the portions of the tramway system that are now isolated should be linked together, through communication being provided from east to west and from north to south.

We believe that much could be done in tramway development without having recourse, at any rate in the first instance, to great and costly street improvements, but, as such improvements are unavoidable, in any case, the preference should be given to those which will facilitate the extension of the tramway system.

The absolute "veto" over the construction of tramways, passed by local and street authorities, should be abolished throughout the area of "Greater London," but with a preferential right to county councils and the Corporation of the City of London, to construct tramways within their districts, if they are prepared to do so.

Tramways should run through from side to side of London, so far as possible, and termini, in the streets and central districts, should be avoided.

In regard to railways, their further development must be governed by the features of the existing and authorized systems, which should be extended and improved; we have suggested various extensions and improvements.

It is important that all possible facilities should be afforded to suburban passengers, arriving at the terminal stations, to reach their destinations throughout the central area by railway, either by means of through trains, or by interchange within the stations to which the suburban trains may run.

In the more crowded parts of London, where property is expensive, railways must be placed underground. Railways in shallow subways are preferable to "tube" railways, where the cost is not prohibitive, or where other considerations do not render them impracticable. We desire to draw special attention to the importance of urban railways, traversing London from side to side ,on routes where there is a heavy traffic, having four lines of way, in order to provide a separate service for fast and for stopping trains.

Owing to the high capital cost of "tube" railways, constructed under present conditions, there is a difficulty in providing a sufficient number of such railways to distribute population over the outlying districts, but we are advised that it is possible to construct a cheaper type of deep-level railway adapted for suburban traffic, with fewer and less expensive stations, and rising to the surface when the open country is reached.

If private enterprise will not construct the necessary railways, the local authorities might be authorized to give assistance in view of the fact that re-housing within the central area involves a heavy loss to the rates, and that it may be cheaper, and will be better in other respects, to help in making healthier residences in the suburbs accessible. Assistance might be afforded, either by remission of rates, or by direct contribution, according to the precedent of the Light Railways Act, 1896, and the recommendations of the Joint Committee of 1901 on London Underground Railways.

In cases where railways exist, but additional train services are required to open up new districts for building, and railway companies decline, and cannot, under the existing law be compelled, to put on additional trains, local authorities might be empowered, if the necessity is urgent, to guarantee, for a limited period, such net receipts per train-mile for the proposed trains as may be reasonable.

In cases where a new railway is proposed to be made, which would have the effect of opening out a district for building purposes, we think that a railway company might be authorized to purchase, under proper safeguards, land, likely to be increased in value by the construction of the railway, by means of voluntary agreement with the owner of such land.

A traffic board should be appointed with jurisdiction over "Greater London," constituted, authorized and required to discharge the duties therein set forth.

CURRENT NEWS AND NOTES.

EARTHQUAKE CONFERENCE.—The International Earthquake Conference met at Berlin, Germany, on August 15. Dr. Theodor Lewald, who was the German Commissioner General to the St. Louis Exposition, was elected chairman. Ambassador Tower received instructions by cable to represent the United States.

MORE ATLANTIC CABLE.—The British cable steamer *Colonia* left England on August 5 for Canso, whence after laying a 200-knot cable across the Gulf of St. Lawrence, she was to start homeward across the Atlantic, laying a new main cable. Of this she carried no less than 8,700 tons. The submarine cable industry seems to be thriving in spite of all the activity in the wireless field.

MUNICIPAL TELEPHONES FOR CHICAGO.—City Electrician Carroll, of Chicago, is proposing to install a municipal system of telephones and is securing bids on some 1,400 instruments, for which cables will be run in the Illinois Tunnel subway. This will apparently involve cutting adrift from the general system of the Chicago Telephone Company, which has hitherto had the maintenance of the municipal telephone service.

INTERNATIONAL SCIENTIFIC EDUCATION.—A dispatch from Berlin August 15 says: "While the liberal press warmly welcomes the proposed interchange of professors between German and American universities, Nationalist newspapers are inclined to sneer at the suggestion. They profess to be doubtful if German science will gain any advantage. American scientific methods, they say, are too embryonic. America possesses hardly a scientist who is able to tell Germany anything valuable; nevertheless, German science is so rich it can afford to be bounteous. They point out, however, that care is necessary lest American influence impregnate German life."

PRESIDENT STAYS ON TOP.—It had been stated in the newspapers that this week President Roosevelt would take a dive at Oyster Bay, Long Island, in the new submarine *Plunger*. This is now denied. The President will stay on top and witness the experiments.

CHICAGO TROLLEYS.—A canvas of the aldermen of Chicago City Council reveals the fact that a large majority is opposed to the institution of condemnation proceedings against the street railway company. This ties Mayor Dunne's hands in his municipal ownership campaign.

BRITISH ASSOCIATION IN AFRICA.—No fewer than 385 members of the British Association for the Advancement of Science have started from England for the meeting in South Africa, and of these 276 will go up country to the Transvaal Colony, Kimberley, etc. There are some Americans in the party. The programme is a most interesting and attractive one.

WIRELESS IN U. S. NAVY.—A special dispatch from Washington of August 11 says: "According to a report received at the Navy Department, ships of the North Atlantic fleet have communicated with one another by wireless telegraph at a distance of about 262 miles. This is announced to be the greatest distance at which wireless messages have been sent from ship to ship in the navy."

EDISON'S BIRTHPLACE.—A dispatch from Norwalk, Ohio, states that Mr. Thomas A. Edison has made an offer to the present owner for the purchase of the house, in Milan, Ohio, in which he was born. Mrs. Mary Ristine, of Chicago, a niece of Mr. Edison, is the owner of the place, and the amount offered by Mr. Edison for the property is stated to be much more than its intrinsic value.

A POLE LINE COMEDY.—A special dispatch from Cincinnati, Ohio, says: "To prevent the Bell Telephone Company from erecting poles along the roads of their locality, farmers of Green Township gathered their children and placed one in each hole that had been dug. Over half the school children in the neighborhood were in the earth up to their chins when the telephone people abandoned their work."

X-RAY LEPROSY TREATMENT.—It is stated that American surgeons connected with the Board of Health at Manila, P. I., are treating leprosy very successfully with Röntgen rays. Of twenty-five cases, six are reported as actually cured, while several patients, portions of whose bodies were gone, have recovered, on account of the check of the disease, no trace of germs being discoverable in the blood.

WORK AT PORTSMOUTH.—Last week we gave an account of the telegraphic preparations at Portsmouth, N. H., for the Russo-Japanese peace conference. All the facilities thus described have been freely used. The telegraph operators are among the busiest people at Portsmouth. On the average 12,000 words a day have been cabled to Europe and Japan. The Russian messages to St. Petersburg have gone over the French lines, as they did not wish them to pass through England. The Japanese dispatches to Tokio have been sent via San Francisco. There has been a large amount of traffic for American and European newspapers.

ELECTRIC COOKING STOVE.—In a patent issued August 8 to Prof. Elihu Thomson a form of stove is described which may be designated as an electric heat accumulator. The stove is heavily jacketed externally with a layer of some good heat-insulating substance, such as asbestos, fire-clay or mineral wool of any desired thickness, and provided with a lid of the same character. Within the jacket is placed a mass of refractory material, and embedded therein is a granular resistance material. It is stated that silicon is particularly desirable as a resistance material, because it has a high specific resistance, a high fusing point, and a suitable temperature coefficient, and, furthermore it is not oxidized at high temperatures. The construction of the stove is such that the whole interior may be maintained red hot for a considerable time by a moderate expenditure of power. It is intended that the current will be turned on in the morning and that the stove will be run the greater part of the day without involving great cost and will be ready at any time for the work of cooking.

AN "ELECTRIC FLUID" CRAZE.—A dispatch from Peoria, Ill., of August 12 says: "The inquest to-day on the body of Edward Drouin, formerly a wealthy Philadelphian, who was found dead in his hallway, disclosed that the interior of their Fisher Street home is filled with furniture of the strangest character, and that the walls are covered with fac-simile reproductions of the 'coat-of-arms' adopted by Drouin and his wife. For some time he had posed as 'King of the World' and his wife as 'Empress of the Universe.' With an energy almost inconceivable, Mrs. Drouin spent hours of each day writing letters to prominent people warning them of attempts upon their lives and asserting that a band of people was threatening the extermination of the populace by turning on the 'electric fluid.'"

THE POLITICS OF IT.—The New York *Times* gives the following summary of the political situation in regard to the New York State Lighting Commission: "The Public Utilities Commission, composed of Frederic E. Gunnison, of Kings; John C. Davies, of Oneida, and Lucien L. Shedden, of Clinton, all Republicans appointed by Governor Higgins, will soon be called on by the Republican State organization, it is said, to justify its existence from an organization point of view by coming to this city and investigating a few supposedly Democratic schemes. The commission organized only last week by electing Mr. Gunnison chairman. It was decided that desk room must be found in Albany, New York and Buffalo. When quarters are found here, the Republican district leaders, from the Battery to the Bronx, will expect a prompt examination of Charles F. Murphy and others with reference to the construction of the Astoria gas plant."

WIRELESS TELEGRAPH RECEIVER.—An extremely simple form of coherer is disclosed in a patent granted August 8 to Prof. E. Branly, of Paris, France, who in 1891 gave to the world the principle of the first or filings coherer. The coherer comprises essentially three rods of polished steel having blunt points resting upon a plate of polished steel. The blunt points of the metal rods are oxidized. The contact of the oxidized with the polished surface possesses the property of preventing the passage of current under normal conditions, but of immediately becoming conductive under the influence of the waves from an electric spark, and of instantly resuming its resistance under the action of a very slight shock. The decohering shock is produced by a tapper which is operated by an electromagnet, the current for which is obtained from a local battery whose circuit is controlled by a relay which is responsive to the current in the coherer circuit. The closing of the circuit of the local battery serves in the ordinary way to throw into action a recording instrument which causes the unrolling of a paper band and the impression thereon on the long and short signs representing dots and dashes of the Morse alphabet.

SENDING A WAR DISPATCH.—In discussing the work of the Associated Press, Mr. Melville E. Stone in the August *Century* describes the ordeals of the war correspondent at the front, and says: "When the battle has been fought, and the correspondent, at great hazard, has written his story, his troubles have only fairly begun. He must 'pass the censor.' This may be easy or it may be most difficult. Much depends upon the character and intelligence of the censor. It is only fair to say that we have found the Russians very reasonable. They have shown far more wisdom than did the American censors during the Spanish war. Next, the messages must be transmitted. The correspondent must be 'first at the wire' or his work may all come to naught. Here, again, he must exercise tact; otherwise a petty telegraph official, who is often a very monarch in his field, may spoil everything. And all along the long line—for the telegram is retransmitted half a dozen times before it reaches San Francisco or New York—the cable officials must be friendly and painstaking and intelligent, or the news will fail to reach its destination promptly and in the form in which it was sent. Delays in transmission are inevitable, and it speaks volumes for the efficiency of modern telegraphy that they are so infrequent. Russian operators, Danish operators, Japanese operators, French operators—all handle and transmit these messages, often in bad chirography, in a language which they do not understand, and they seldom make a serious mistake."

SUBWAY FOR PITTSBURG.—A syndicate, headed by M. A. Verner and Mayor William B. Hays, has applied for charters for a subway system for Pittsburg. The sum of $10,000,000 will be involved in the deal, and work will be started as soon as the charters are granted.

ILLINOIS INDEPENDENT TELEPHONE.—At Peoria, Ill., on August 8, the Illinois Independent Telephone Association elected officers as follows: President, E. R. Conklin, Aurora; vice-president, Manford Savage, Champaign; secretary, C. B. Cheadle, Joliet; treasurer, C. S. Hankin, Decatur. It was decided the State should be divided into three large districts for better co-operation and service.

OHIO ELECTRICAL CONTRACTORS.—The Electrical Contractors' Association, of Ohio, held its annual meeting in Toledo, on August 9, in the rooms of the Builders' Exchange, and elected the following officers: President, Charles S. Hall, Dayton; vice-president, Emil Grah, Toledo; secretary, A. Oppenheimer, Cleveland; treasurer, J. C. McMasters, Columbus. There were about 30 present. The meeting was called to order by President Hanson, of the local branch. W. H. Morton, of Utica, N. Y., national secretary, and Past-President McCreary, of the national organization, were present The delegates had dinner at the St. Clair Hotel, after which they took a trolley ride around the city and enjoyed supper at the Toledo Yacht Club, spending the evening at the Casino.

FLOATING POOLROOMS, with wireless service, have had a lively time off Chicago, but the end is not yet. There are more torments in store for the race track gamblers whose last hope of evading the law is precariously reposed in Commodore "Bud" White's wireless flagship, the *City of Traverse.* The plan is to erect a wireless telegraph mast and station on the roof of the Chicago City Hall at city expense. It is said a continuous operation of the sending apparatus during the afternoon while the races are being run would prevent the De Forest station from getting into intelligible communication with the steamer. When Commodore "Bud" White is waiting the returns on the first race his guests will receive this from Assistant Chief Schuettler: "The eyes of the Lord are in every place beholding the evil and the good." When the odds are posted on the second race the bettors will be warned: "Woe to him that ganeth an evil gain."

"THIRD-RAIL EYE."—All kinds of funny new diseases are credited to electricity. The latest is recorded as follows: "For some time motormen on the Union Railway in the Bronx have been reporting trouble with their eyes. Every day a few of the men would report ill. Their eyes were in such a state that it was impossible for them to attend to their duties. There were several investigations, but the mystery remained unsolved until Traffic Superintendent William Hansen decided to investigate for himself. After one trip over the line Mr. Hansen also suffered just as the motorman had. An examination by an oculist showed that there were sixty minute pieces of steel in his eyes. It is believed that these particles are thrown from the third rail when the power shoes of the Third Avenue Elevated cars overhead rub over them. The showers of powdered steel strike the motormen in the face. As the men have no trouble in the winter time, when they are behind the glass partitions, it is proposed to supply them with automobile glasses to guard against the danger."

SAFETY ON ENGLISH RAILWAYS.—The general report to the London Board of Trade on railway accidents in 1904, issued on July 17, states that the danger of railway traveling has been reduced to such a point that in 1904 the chances against a passenger being killed in a train accident in the course of a given journey were more than 200,000,000 to 1. The risks incurred by railway servants, especially those concerned with the movement of traffic, are of course much greater. In their case there is an element of danger which cannot be eliminated, though its effect may be minimized by the adoption of suitable appliances and safeguards. The increasing use of such appliances is having an appreciable effect, but it is claimed that the carelessness engendered by familiarity with dangerous conditions appears to be responsible for so many accidents that it is unreasonable to expect any marked reduction in the total number of accidents to railroad servants. These figures show that it is much safer to travel in England than in America, and should induce the greater adoption in this country of safety signals, etc.

Electrical Engineers of the Times—XXIII.

MAX LOEWENTHAL.

Max Loewenthal was born at Oldenburg, Germany, on February 22, 1874, his father being a merchant in that old military town, where he received his elementary education and attended the Gymnasium (college) for three years. When thirteen years of age his family, on account of business reverses, emigrated to the United States. During the first six months he attended public school, and stood second in a class numbering 55 pupils, although he was not versed in the English language—all questions having to be asked him on a slate, to be translated by him before replying.

In the fall of that year, 1887, he entered the Hebrew Technical Institute, New York, and in 1890 was graduated from that institution, in the electrical course, with honors. He was then but 16 years of age, and his essay on the phonograph, delivered on the occasion of his graduation, was reprinted in several magazines. After graduation he became laboratory assistant to Mr. George A. Hamilton, chief electrician of the Western Electric Company, and, in 1891, he accepted a similar position with the Schuyler Electric Company, Middletown, Conn., under Mr. E. R. Knowles. Feeling the need of higher education, he prepared himself evenings for the entrance examinations to some university, and saved sufficient funds by practicing economy and teaching drawing at the Young Men's Christian Association, to enable him to leave his position in the beginning of 1893, and pass all the entrance examinations at Columbia University in the spring of that year. There he earned a scholarship during the first year at college, which enabled him to go through his course without the payment of any tuition fee.

He was graduated from Columbia with the degree of Electrical Engineer in 1897. During the remainder of that year he wrote a

MAX LOEWENTHAL.

number of text-books for a correspondence school, and, in 1898, joined the editorial staff of *The Electrical Engineer,* remaining in that position until the consolidation of that journal with *The Electrical World.*

He then was interested in train lighting for some time and equipped the first tug in the harbor with an electrical equipment for lighting operated from the propeller shaft. He next associated himself with the late Max Osterberg, in consulting electrical work, and, in 1901, was one of the organizers of the Prometheus Electric Company, manufacturers of electric heating apparatus, of which company he is now secretary and electrical engineer. He has developed and received patents on a large variety of electric heating and cooking appliances, and was awarded a personal medal at the St. Louis Exposition for his contribution to the electrical heating industry. He also prepared the electric heating chapter for "Foster's Electrical Hand Book."

Mr. Loewenthal has been, for a number of years, instructor in mechanical drawing in various evening schools, also one of the lecturers for the New York Board of Education, on technical subjects, and has been a frequent contributor to electrical and scientific magazines. He is an associate member of the A. I. E. E., vice-president of the New York Electrical Society, a member of the Pi Lambda Phi Fraternity and the New York Press Club, as well as of a number of educational and charitable organizations.

An Italian 40,000-Volt Transmission Plant.

BY FRANZ KOESTER.

AMONG the interesting high-tension hydro-electric plants of Europe is that located at Gromo, on the Serio, a mountain stream in the northern part of Italy. This plant, officially opened July 11, 1904, was designed and built by the Brown, Boveri Co., of Baden, Switzerland, for the operation of the spinning mills of Messrs. Crespi & Co. and various other industrial plants at Nembro, a small town some 20 miles distant. Up to the present time the hydraulic power has been utilized only at the former town, but it is intended at a later date to utilize the power also at a higher point, finally using a total of 4,000 hp, double that at present generated.

The power plant has been located only a short distance from the town at the foot of the mountain down which the penstock leads, the lower part of the latter being led under ground right up to the building. Three Escher-Wyss water turbines are at present installed, direct-connected to three 4,000-volt, three-phase alternators designed for a continuous capacity of 1,000 hp with a power factor of .80. The frequency is 50 cycles at 500 r.p.m. The efficiency of these generators at full load is something better than 93 per cent and at half load 90 per cent. Fig. 1 gives a general view of the generating room, showing the three main generating sets in a row and one of the two 25-kw, 115-volt exciters which are also driven by water turbines. The third generator is held in reserve and will operate in case of emergency only.

Each generator feeds directly to the primary of an 850-kw. step-up transformer, the secondary circuit containing the switches and necessary apparatus for parallel operation. Thus the turbine, generator and transformer constitute practically one unit, which method is distinctly modern. The elimination of bus-bars between the generators and transformers practically cuts the number of measuring instruments, etc., in half. The current and tension transformers for ammeters, voltmeters and overload relays of the automatic switches are connected to the low-tension side, thus considerably reducing the first cost of the installation.

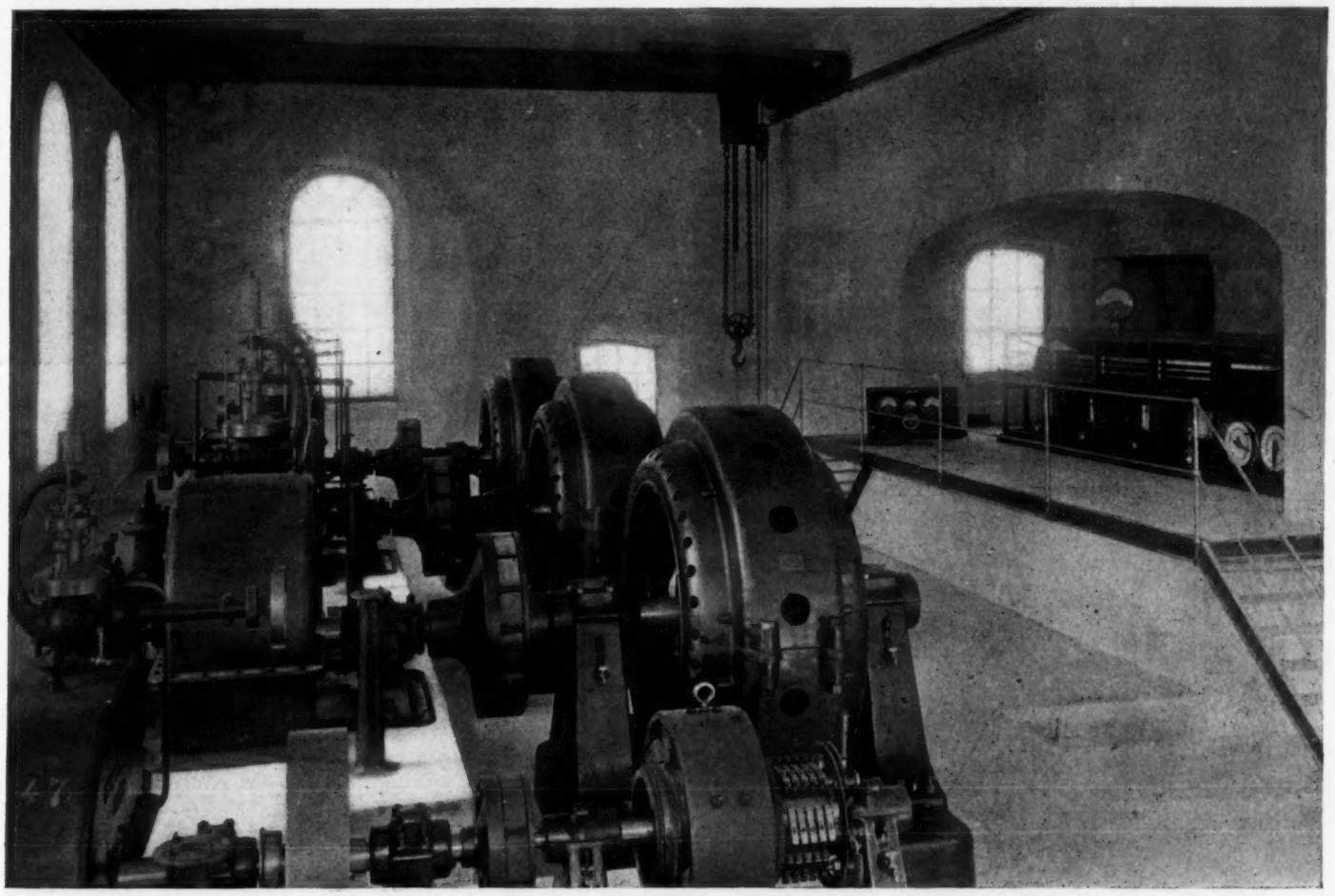


FIG. 1.—GENERATING ROOM.

The transformers are of the Brown, Boveri oil-insulated, water-cooled type, requiring on the average about 18 liters of water per minute at a temperature of approximately 18° C. The primary and secondary sections are wound in the shape of concentric cylinders and are separated one from the other by strong insulating partitions, and as a still further safeguard against breakdown, the secondaries are wound on the sandwich principle, each subdivision having a terminal potential difference of 300 volts. These transformers were subjected to a flash test of 67,000 volts.

All the switching apparatus for this plant is located in a special building adjoining the generating room. This switch house, as it might be called, consists of a basement and three stories, each of which has a floor space of 32 by 23 ft. The basement is divided into two compartments; the first, situated 4 ft. below the generating room floor level, contains the regulating resistances and the framework for the 4,000-volt apparatus, while the second is located above the generating room floor and contains the transformers. A wide trench is provided under the generating room floor through which the exciter and primary (4,000-volt) leads pass. The first story is also divided into two compartments. The first, shown at the right in Fig. 1, gives access to the generator room and forms a gallery from which the complete installation may be viewed, and contains the main operating board with switch hand wheels and measuring instruments (see Fig. 2). The secondary automatic switches and the three current transformers for the line feeders are installed in the second compartment. The third story is reserved for the lightning arresters and line feeders.

A separate frame is provided for each generator and carries three high-tension, tube-type, single-pole fuses with blow-out horn, one potential transformer and two current transformers. This framework is made completely of iron with the sides covered with perforated metal sheeting and removable front shields which allow inspection or replacement of fuses.

As previously stated, the leads pass directly to the primaries of the transformers, entering the transformer room through glass tubes cemented into the dividing wall. The high-tension automatic switches are located directly below the high-tension bus-bars. A front view of these switches is given in Fig. 3. These are of multi-

ple-break, single-pole type, but operated simultaneously. On the left is shown one of the line switches while the other two belong to the hydro-electric transformer units. Each switch is mounted in a separate fire-proof compartment with 5-in. dividing walls. The oil

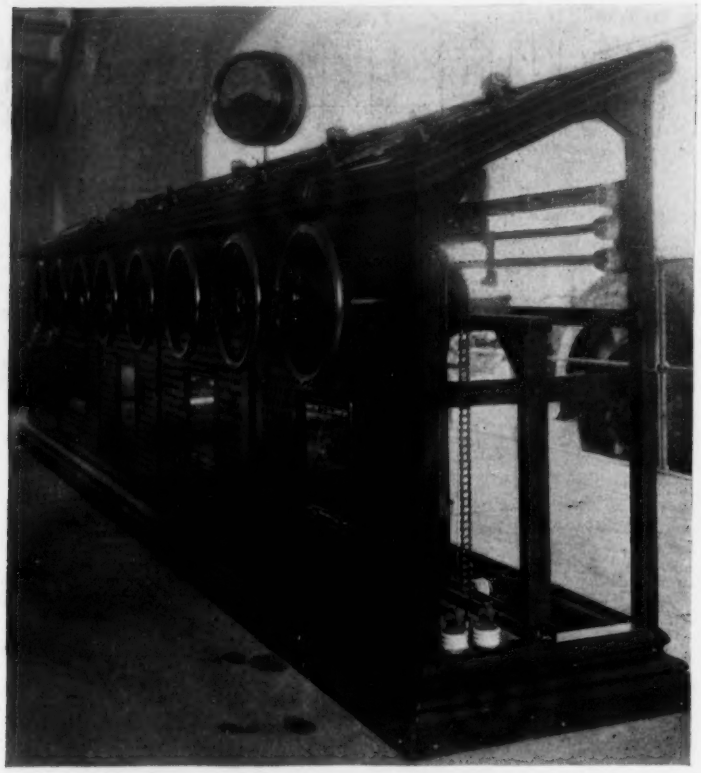


FIG. 2.—SWITCHBOARD.

reservoirs are arranged so that they may be easily lowered for inspection, etc.

As shown in Fig. 2 the generator board is built in the form of a desk inclined toward the generator room and placed in the gallery

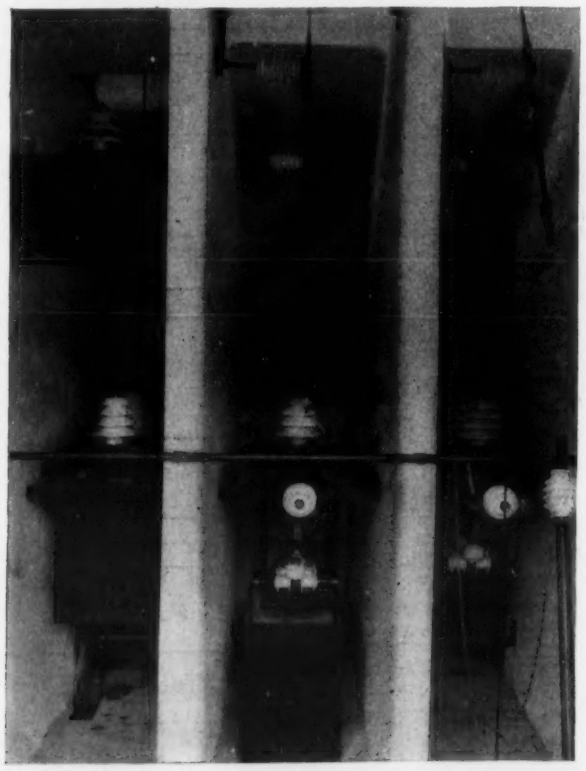


FIG. 3.—FRONT VIEW OF AUTOMATIC HIGH-TENSION SWITCHES.

in such a position that the attendant may stand at the board and at the same time overlook he entire plant equipment. The operating board is equipped with only low-tension apparatus and consists of three generator panels, one feeder panel and one exciter panel. Each generator panel contains two hand wheels, one for the high-tension oil switches and one for the low-tension regulating rheostats. The latter are so arranged that they may be connected together and the generators simultaneously regulated when running in parallel. Each panel also has an overload relay, those for the units being two-pole and that for the line three-pole. The push button for the automatic release of the high-tension switches and the phase lamps and tumbler switches for the same are mounted on the table. It is interesting to note that no marble or slate was used in the construction of the board. The lightning arresters, as previously stated, located in the third story, are of the well-known Wurts type and are insulated from the earth by several porcelain insulators.

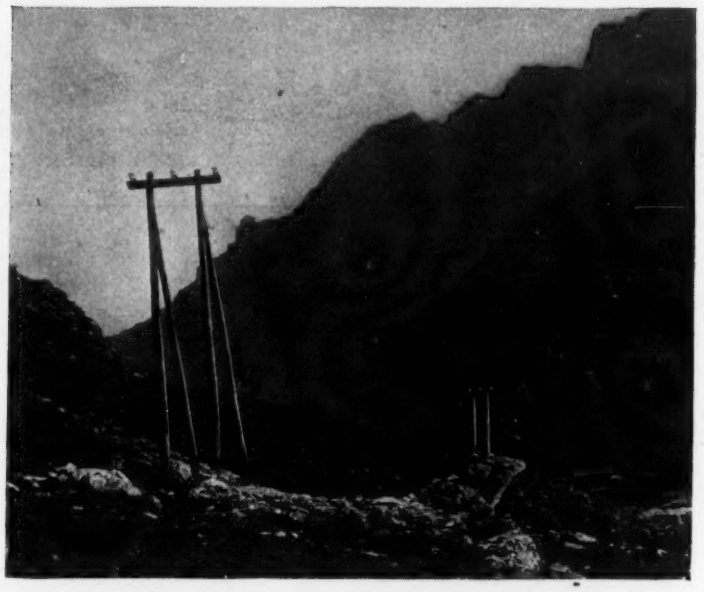


FIG. 4.—ANGLE AT THE "DEL COSTONE" BRIDGE.

The lines leave the building through heavy glass tubes inserted in the window panes and held in position by means of copper sleeves soldered to the leads. The line is approximately 20 miles long and follows more or less the River Serio through the Seriana Valley. It consists of three high-conductivity bare copper wires 6.5 mm. in diameter mounted on delta insulators and is designed to transmit 4,000 hp with a drop of 5 per cent. The insulators are of special design and besides having all the ordinary advantages of the delta type were subjected to especially severe tests. With the atmospheric

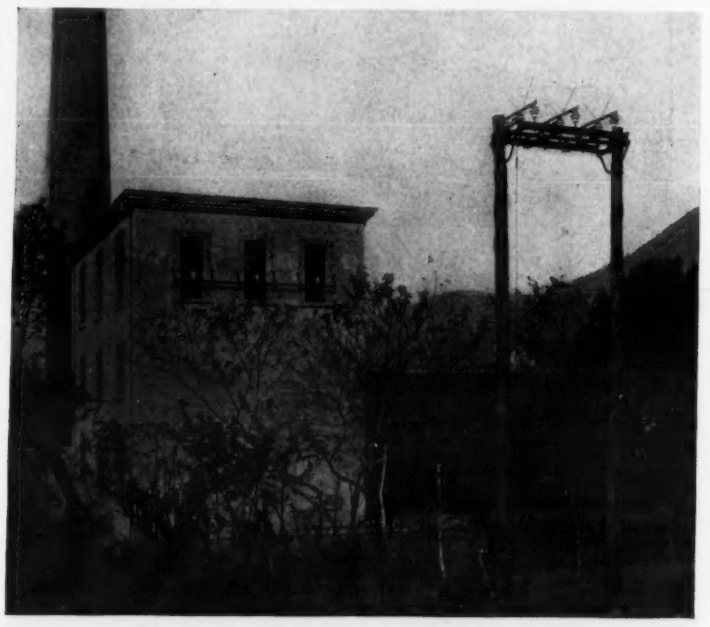


FIG. 5.—SAFETY SWITCH AT NEMBRO SUB-STATION.

humidity at 62 per cent it required 89,000 volts to jump a spark to the iron support, and in an artificial rain corresponding to a precipitation of 1½ in. per minute, 54,000 volts. The insulators were finally subjected to a flash test of 80,000 volts. They are mounted

on wooden poles and cross arms, the standard height being 25 ft. The lower insulators are placed 23½ ft. above the ground except at crossings, where this is increased to 29 ft., the poles here being 30½ ft. above the ground. Where long spans and sharp curves occur two poles have been erected and the insulators mounted on cross arms 3 ft. apart (center to center). The longest span is 400 ft. and the sharpest angle that at the Del Costone Bridge, which is 145° (see Fig. 4).

The line enters the transformer sub-station at Nembro through a three-pole emergency switch (see Fig. 5), mounted on a pole close to the station, thus making it possible to isolate entirely the sub-station. This switch is so arranged that when it is opened the line entering the sub-station is short-circuited and grounded, thus making it impossible for any foreign body to complete accidentally the circuit and energize the sub-station apparatus. After passing this switch the line enters the sub-station in exactly the same manner as it leaves the generating station. As will be seen from the double-pole construction illustrated in Fig. 5, the line is well protected by lightning arresters of the horn type.

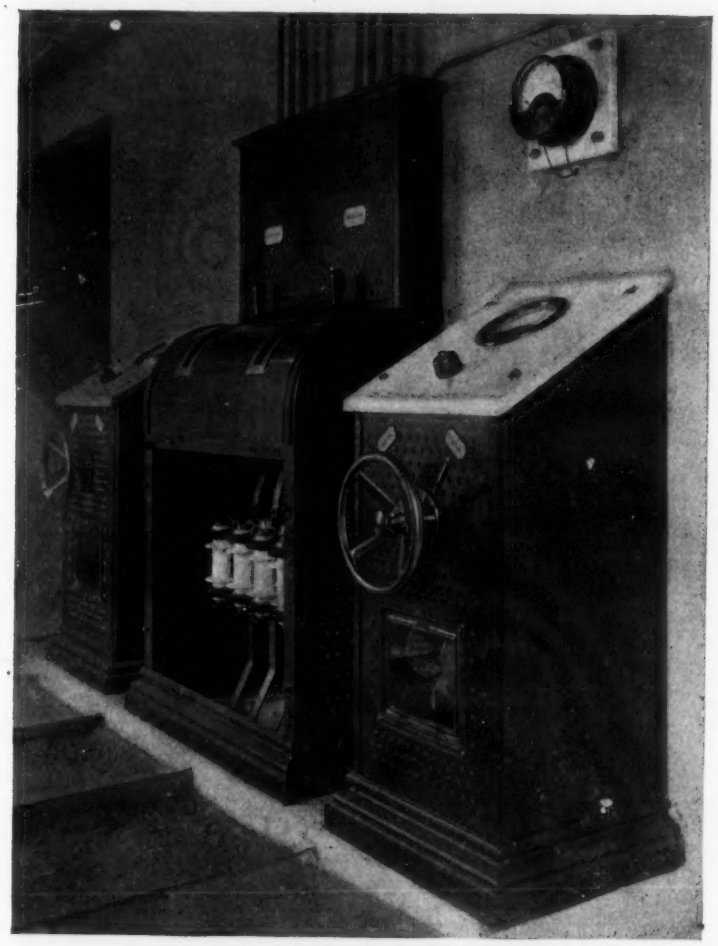


FIG. 6.—SWITCHBOARD FOR PRIMARY AND SECONDARY TRANSFORMER SIDE AND FOR 500-VOLT FEEDERS.

The sub-station is a two-story building, both floors being divided into two compartments. The second floor contains the lightning arresters and leading-in arrangements in one section and the high-tension bus-bars in the other. The apparatus at Gromo is so regulated that the potential at these buses shall be 38,000 volts. From these bus-bars the current passes through the high-tension oil switch, which are of exactly the same type as in the Gromo plant, to the primaries of the transformers located in the rear room of the ground floor. In the front room of the basement there are at present two desk type panels of the same design as those installed at Gromo except that there is only one hand wheel for the main switches and the two-pole overload relay (see Fig. 6). In this room is also located the distributing panel for the 500-volt secondary system, carrying two 500-volt switches and the necessary fuses. The framework of this distributing panel is entirely of iron and self-contained, all the current-carrying parts being protected by sheet iron. The low-tension feeders pass through the upper part of the building and thence out to the motors, etc.

Inter-Relation of Ballast and Glower in the Nernst Lamp.

BY LEWIS A. TERVEN.

THE problems presented by the glower and the ballast are very difficult taken singly, but when a problem of one is complicated by inter-connection with a problem of the other, the case becomes very complicated. It has been often said that the more complicated in theory an apparatus is, the simpler it operates in practice. While this is of itself untrue, at the same time the saying carries some truth. It is well known that the induction motor is an apparatus capable of a great deal more abuse than the direct-current motor, although direct-current apparatus is much simpler in design. Such is the case with the Nernst lamp. That it is a complicated lamp is freely granted, but that these complications interfere with the operation of the lamp is not admitted. The understanding of the physical occurrences of minor importance in the filament of the ordinary incandescent lamp offers just as many difficulties as do the parts of the Nernst lamp, but these small things have never been thoroughly investigated for the simple reason that there was no practical use in doing so.

Because the Nernst lamp glower is an unstable device it is necessary to use a steadying resistance in series with it and this resistance has been called the ballast. As is commonly known, the ballast used consists of a fine iron wire, sealed into a bulb containing hydrogen. The hydrogen not only prevents the iron from oxidizing, but on the other hand it materially affects the molecular arrangement of the iron resistance, so that the curve between current and volts is found to be much steeper in a hydrogen atmosphere than it is under other conditions.

Fig. 2 shows the normal ballast curve. It will be seen that the rise in resistance of the iron wire is quite rapid just above the point upon the curve where the lamp is normally operated. The ballast curve is usually plotted on the basis of percentage. This is the only fair way to show a ballast curve, but the current scale is extended in the curve shown, which makes the ballast curve appear flatter than it really is. The ballast is a very interesting piece of apparatus from quite a number of standpoints. The shape of the curve may be changed and one may get a different characteristic from the lamp by working at different points upon the curve. The selection of the proper quality of the iron to be used for wire is of very great importance.

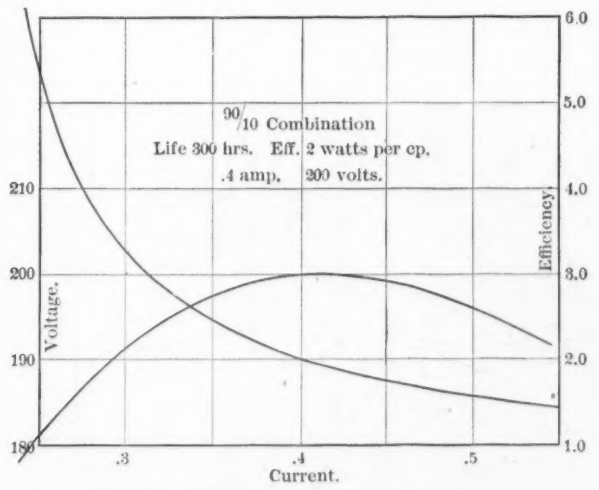


FIG. 1.—CURVE ON AVERAGE GLOWER.

The beauty of the ballast is its sensitiveness. The reverse of sensitiveness is known as sluggishness; that is, failure of the ballast to immediately respond to changes in the line voltage. This is due to the specific heat of adjacent materials, as well as to interheating of parts and other things.

The glower curve is shown in Fig. 1. This curve was taken at 300 hours and is much steeper than the usual glower curve. In other figures, such as Fig. 4, glower curves are shown where the glower had been run only an hour. It can easily be seen by inspection that the glower changes its characteristic remarkably with age.

A very peculiar point is to be noted here. While the glower surface emission deteriorates about 13 per cent cent during its life, the

point upon the glower characteristic at which one operates at constant efficiency does not shift, or at least if it does shift, moves over toward a more stable position. This can be seen by an inspection of Fig. 3. The curve shows a very rapid rise in stability during the first 100 hours, after which the curve is flat. By stability is meant the ratio of the abscissa of the peak of the curve to the abscissa corresponding to the point of 2 watts per candle-power on the glower curve between current and voltage. Of course, it must be borne in mind that the glower may be operated beyond the peak of the curve, in which case the stability must be reckoned as a negative quantity.

In a previous paragraph the need of a ballast has been referred to. The necessity can be easily seen by reference to any of the later curve sheets of the paper. In Fig. 2, which shows two lamp curves taken from an aged glower, one of the curves is taken in connection with a normal ballast, while the other one is taken in connection with a straight resistance, which consumes 20 volts at .4 ampere. Lamp curve No. 1 shows how a rise in voltage is easily taken care of by the ballast, while curve No. 2 shows a very unstable lamp, and a rise of 5 per cent in voltage would mean the destruction of the glower. If a simple resistance is to be used as a ballast, the percentage of ballast would have to be increased from 10 to 30, in order to take care of the variation in line voltage, and even

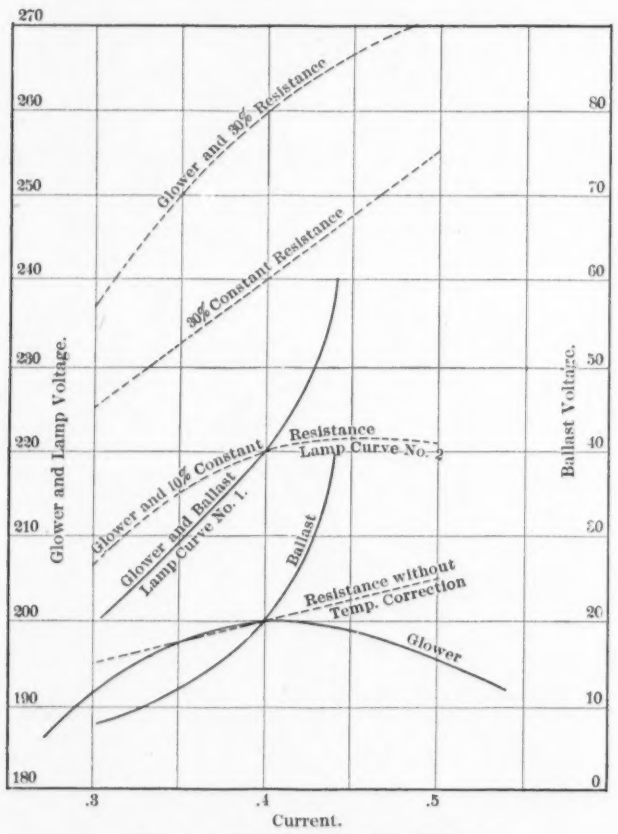


FIG. 2.—NORMAL BALLAST CURVE.

this 30 per cent resistance does not accomplish the same result as the 10 per cent iron ballast. One advantage of the ballast, which has no temperature co-efficient, is due to the fact that the lamp is non-sluggish and the glower never gets an excess current, except that corresponding to an over-voltage circuit. The question of ballast sluggishness is a very broad one and is much too extended to be taken up in this paper.

The best way to learn how the ballast and the glower combine to make the lamp is to study curves illustrating different cases. Theoretically one has an innumerable variety of circumstances. For instance, the glower may be normal or it may be squirted for too low or too high an efficiency. The ballast with which these three glowers are combined may be a normal, an under-voltage or an over-voltage ballast. Taken in this way, nine curves would result, but all of these are not necessary. In Fig. 4 the normal ballast curve is combined with the normal glower curve to produce the normal lamp characteristic. The lamp curve so shown is very stable, and the lamp will withstand a 10 per cent excess of voltage for continuous service.

The lamp will stand a temporary over-voltage of 20 per cent without injury. On the same sheet (Fig. 4) a lamp curve is shown corresponding to a glower which is 5 volts lower sorted voltage than it should be. This corresponds to a method formerly used for so-called glower correction. During the early stages of the Nernst lamp development, and in fact up to 1903, glowers commonly had quite a rise in voltage during life. This amounted to from 3 to 4 volts per 100 hours on constant current. When such a glower is run in the lamp, during the first 100 hours it does increase in volt-

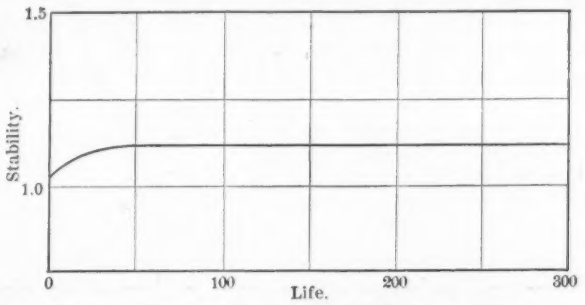


FIG. 3.—CURVE SHOWING STABILITY OF GLOWERS.

age by 3 volts, but afterward, because of running at a higher current, caused by a rise in glower voltage, the rate of rise in voltage of the glower is very small, because the rise in voltage of the glower is a direct factor of the specific consumption at which the glower is operated.

In order to partially overcome this feature, glowers after being sorted had a certain glower correction applied to them. This amounted usually to 4 or 5 volts and was supposed to correspond to the rise in voltage of the glower during the first 300 hours, i. e., a 195-volt glower would be rated as a 200 and at the end of 300 hours the voltage of the glower would really be 200 volts, which would put the lamp on its normal basis. It is seen by reference to the curve that this expedient threw the ballast into the position of an over-voltage and the over-voltage which the lamp could stand was decreased thereby. At the same time the glower ran at a larger current than normal and necessarily gave more light than it was intended to give and the efficiency was accordingly much higher than normal. Under such circumstances the decrease in candle-

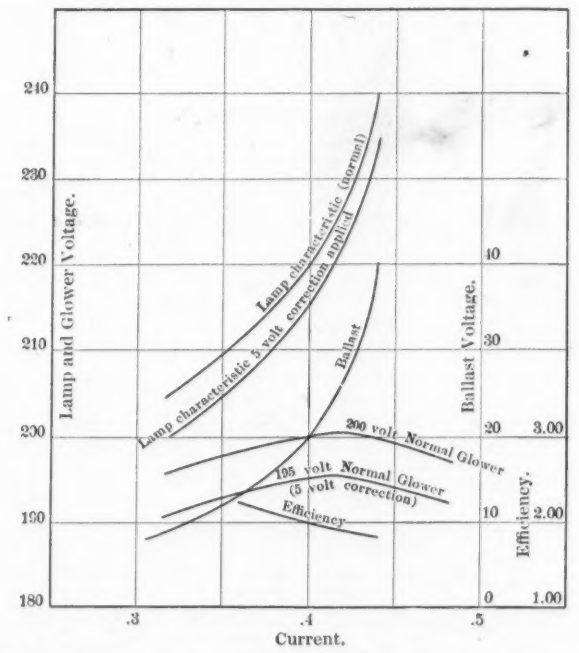


FIG. 4.—EFFECT OF GLOWER CORRECTION ON NORMAL GLOWER.

power of the lamp was very rapid. The custom of adding glower corrections was done away with in the early part of 1904, due to an arrangement being made to correct the glower mixture so as to get a material giving a very small rise in voltage with life.

Fig. 5 shows a normal glower when combined with a ballast running high in current. By referring to the efficiency curve it can be easily seen how the glower must do over duty when running with a ballast which takes an excess current, while the glower in the lamp with a small current ballast does not operate at a specific power consumption sufficiently low for a satisfactory efficiency.

A very peculiar thing may happen in case of a circuit with bad regulation, and a concrete example occurs to me which explains what I mean. Some single-glower lamps were installed upon a circuit which had a very bad regulation, rising from 104 to 117 volts, and staying at the latter figure throughout the latter part of the night. In the morning when the light was really needed at its best the voltage was down to about 108. Now, ordinarily, had we installed 112-volt glowers, 108 volts would have given a fairly good light, but it must be remembered that these glowers had been operated during the night on an over-voltage, and after quite a deal of service upon over-voltage necessarily rose to meet the maximum demand; that is, the glower tried to approximate the necessary voltage to take 0.4 amp. on 117 volts. Now, when burned on 108 volts one can readily see how small the current taken will be. Such a case is not against the glower, but really shows how it accommodates itself, just as the human eye adjusts itself for the maximum light within vision.

The effect of missing the die is shown in Fig. 6. One glower has a specific consumption of 2.15 at 0.4 amp., while the other has a consumption of 1.85 at 0.4 amp. When compounded with a normal ballast the glower which resulted from the large die does not get its full amount of current necessary to bring it to 2 watts per candle power, as can be seen from its efficiency curve, while the glower with the small die gets more current than it should and runs at an over-consumption and strains the ballast. In Fig. 7 the worst conditions possible have been shown. Here ballast curves have been plotted where the current is too high and too low. Glower curves have been plotted where the consumption of the glower is too high and too low. By combining the ballast which runs low with the glower which runs at an under-consumption the worst conditions are obtained for light emission. This may be seen by reference to curve No. 1. Lamp curve No. 2, which is made from the ballast curve with high amperage and the glower curve with too high consumption, is seen to be more unstable. This is because the glower runs at such a consumption as to bring it over the bend of the curve. Such a lamp will give a great deal of light, but will strain the glower. In the previous example the glower will receive no injury, but the ballast will be strained.

For easy reference there is compiled a table of strains. A strain is always referred to the normal lamp, which consists of a normal glower in series with a normal ballast. When either the glower or the ballast in a lamp is abnormal it is presumed that the parts suffer

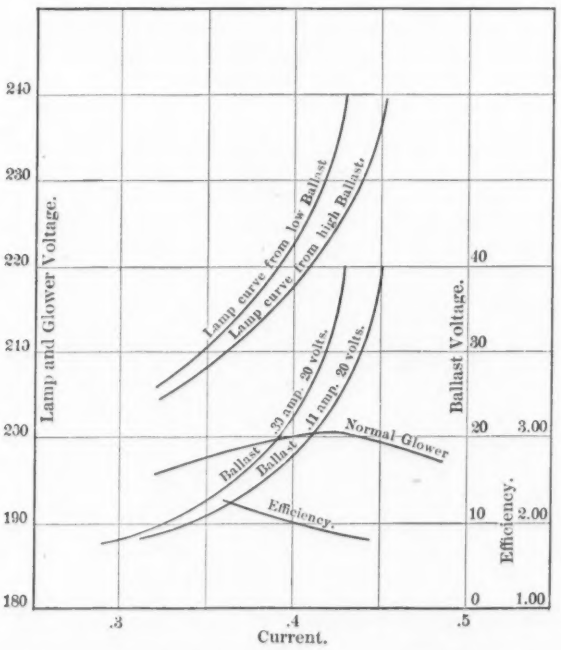


FIG. 5.—EFFECT OF HIGH AND LOW CORRECTING BALLAST.

as the standard product would under conditions which produce a similar strain. For instance, if a ballast which runs 0.39 amp. at 20 volts is put into a lamp and the lamp current is found to be 0.395, the ballast is in a condition of strain, because its normal is 0.39 amp. instead of 0.4 amp., as in the case of the regular product.

The check of any strain when referred to a similar strain upon the normal lamp is that the condition of the glower or ballast considered shall be physically the same; thus glowers are compared on the basis of equal efficiency (specific consumption) and ballasts on the basis of temperature of the iron resistance wire.

Numerical examples will illustrate the methods described. Take the case of the lower consumption glower and low ballast shown in Fig. 7. A lamp composed of these parts would take 0.397 amp. at 220 volts. The normal for the glower is 0.43 amp; that is, at this amperage the glower runs at 2 watts per candle power. Hence the glower is running at a current 0.033 amp. less than its normal. When compared to the normal lamp we find that a current of 0.368 of an

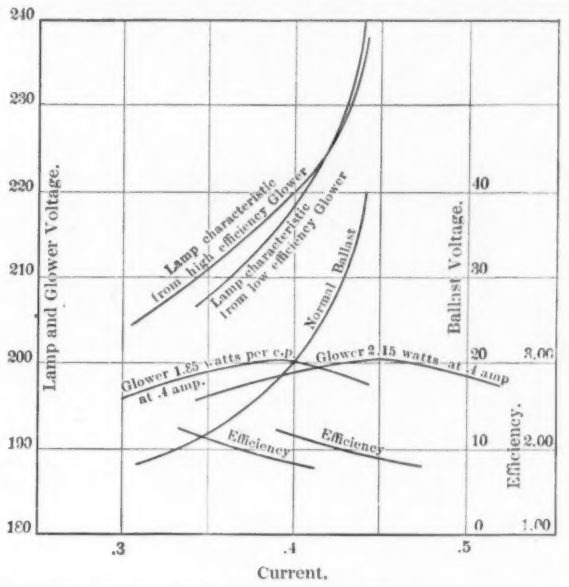


FIG. 6.—EFFECT OF COMBINING WITH A NORMAL BALLAST A GLOWER WHICH HAS MISSED THE DIE.

ampere is required to produce similar conditions, so far as the glower is concerned, when

$$\frac{.397}{.43} = \frac{x}{.400}, \text{ or } x = .368 \text{ amp.}$$

Referring this amperage (0.368) to the standard curve of Fig. 4, it is found that 212.8 volts is the lamp voltage which will produce 0.368 amp. in a normal 220-volt lamp.

For the ballast we have the current as above at 220 volts upon the abnormal lamp, equal to 0.397 amp. Now, the ballast normal is 0.39 amp., and equating as above:

$$\frac{.397}{.39} = \frac{x}{.4}, \text{ or } x = .407 \text{ amp.}$$

In other words, a current of 0.407 amp. flowing through a normal ballast produces a strain upon it which is equivalent to the strain produced upon a 0.39-amp. ballast when 0.397 amp. flows through it. Comparing this value with those found from the curves of Fig. 4, it is seen that 221.9 volts upon a normal lamp will produce 0.407 amp.

The table of strains shows several things that could not be well obtained by a glance at the curves. Above all, it shows the great care that must be exercised in the manufacture of the glower and ballast, that they will not vary in their relations to each other.

TABLE OF STRAINS.

	Equivalent circuit voltage on glower.	Equivalent circuit voltage on ballast.
Five volts correction on normal glower	224.8	224.8
Low ballast with normal glower.....	217.5	220.4
High ballast with normal glower.....	222.5	219.6
Low consumption glower and normal ballast.....	214.2	221.0
High consumption glower and normal ballast....	232.0	219.0
Low consumption glower and low ballast.....	212.8	221.9
High consumption glower and high ballast....	240.0 plus probably 245.	220.0

The fact has been mentioned before that the glower characteristic can be materially changed by altering the proportions of chemicals used in manufacture. One certain mixture is adhered to because it is found that this mixture gives the best all-round working results, but the standard mixture is not quite so stable as a glower mixture differing only by a small percentage in its components. The curve may also be slightly changed by altering the physical characteristics of the chemicals used, without varying the proportions. It is an important

matter to get as steep a characteristic as possible and one which does not reach the knee of the curve between volts and current until a very good efficiency has been attained. However, it does not seem possible to do much better than is now being done.

When a glower is first run a great deal more light is emitted from its surface in proportion to the temperature at which it is operated than happens afterward in its life. This is explained by the fact that the glower surface initially has a selective radiation; that is, the radiation is concentrated in the visible spectrum. It is not certain that the glower has a selective radiation. The phenomenon is possibly caused by the fact that the glower has a certain porosity when new, but with age it attains a crystalline structure. The quality of the light does vary with the surface. When the glower is new the light is of a whiter hue. As the glower obeys the common law for black bodies heated to incandescence, although it is a white body, the hue of the light depends upon a function of the absolute temperature of the glower. The quality of the light may also be shifted toward the blue end of the spectrum by absorbing rays that fall within the red and orange part of the spectrum. The light falling upon a surface after being transmitted through a thin

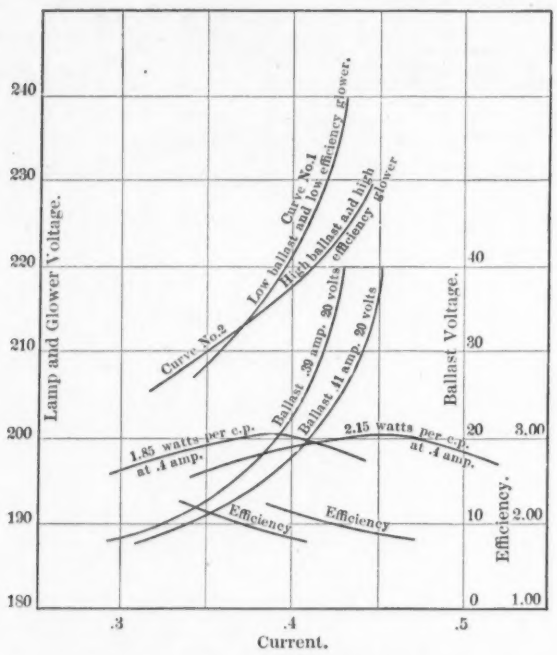


FIG. 7.—EFFECT OF OOMBINING A GLOWER WHICH HAS MISSED THE DIE, WITH HIGH AND LOW CORRECTING BALLASTS.

cobalt glass wall will appear very white, even though the glower may be operating at a specific power consumption as high as 2½ watts per candle power.

Because daylight differs so much owing to different amounts of diffusion which it has undergone, it would be difficult to give a table showing how near the Nernst glower approaches daylight for different efficiencies. If a glower is exposed to the sun on a bright day and it is attempted to make the light of the glower falling on a white screen equal in value to the light falling direct from the sun, it will be found that the glower must be operated at as low a consumption as 1.2 watts per candle power. Under such circumstances a glower will not live very long. On the other hand, if one wishes to duplicate diffused daylight in a hall it can be easily done with glowers running at 2 watts per candle power, but it must be remembered that if shades are put upon the glowers the tendency is to throw the spectrum down toward the red end. The diffused light in ordinary residences is duplicated almost exactly by the light received from Nernst lamps using opalescent balls absorbing about 16 per cent of the light passing through them. Heavier balls usually give a yellowish effect to the light. Sand-ballasted and etched balls do not play so much havoc with the color value of the light.

In what precedes is given a study of the ballast and the glower under circumstances where a sufficient time has elapsed after starting the lamp that the operation of the lamp will have attained its final value. Everything is much more complicated during the time the lamp is starting and up to thirty minutes after the switch is turned.

The Electrical Equipment of Manaos Harbor, Amazon River.

BY CHARLES J. SEIBERT.

FOR some two years past the Manaos Harbor, Limited, has had in constant service, at the port of Manaos, on the Amazon River, 1,000 miles above Para, a system for handling cargo, which has proved to be very successful, and therefore a short description of the same may be of interest.

The contract between the Federal Government of Brazil and the company known as the "Manaos Harbor, Limited," calls for the latter party to execute the following works: "To grade the bank of the river from the extreme points of the city, construct warehouses, inclines, permanent works and floats for steamers of all sizes to go alongside at all times of the year; also the discharging and loading of all merchandise and warehousing of same from both large and small steamers."

In order to carry out the terms of this contract it was found necessary to provide floating landing stages at some distance from the shore line, as the annual rise and fall of the Amazon River is in the neighborhood of 40 ft., with a very flat grade to the shore. In order to establish a means of transferring cargo between these floating stages and the warehouses a specially constructed sectional steel pontoon was designed, shipped in small parts from England and

FIG. I.—HEAD TOWERS OF CABLEWAYS.

the parts assembled in Manaos. This steel pontoon measures approximately 300 ft. by 60 ft. and carries the "head" towers of three two-ton Lidgerwood cableways, the "tail" or shore towers being erected in bays between the warehouses on the river bank. Each of these cableways is capable of transferring 70 tons of cargo one way between floating stages and warehouse, and this rate is easily maintained with native operators.

These cableways are of the double-track cable type and have a span of 550 ft.; the shore end of the track cables are not made fast, but, passing over sheave wheels at the apex of the towers, are fastened to vertical counter weights of 10 tons sliding in guides on the far side of the tower. Thus the strain on the track cables can never be greater than the initial strain due to the counter weights. Both the endless and hoisting lines operating the to and fro motion of the carriage and the hoisting fall, are operated by means of a special double-drum winch direct geared to a 75-hp, 250-volt, series-wound, direct-current motor, located in the base of the "head" tower on the float. The controller for the motor and levers for operating friction clutches and brakes for endless and fall line drums are placed in an elevated shelter on the tower in such a manner that the operator may have an unobstructed view.

As regards the practical operation of this system, it may be of interest to state that these cableways were put in operation in June, 1903, and have been in continual daily operation since without a single accident, and this it should be noted with ordinary labor such as may be secured among the native longshoremen or steamboat sailors. It may also be noted that a large amount of work is done at night, in many cases a single operator working eighteen hours

per day. Besides an operator for each cableway (who receives 9 milreis or about $2.70 for ten hours' work and double pay for overtime), an attendant is employed to oil the winches, cable sheaves, etc., and exercise a general supervision over the machinery while it is in operation. (This attendant receives ten milreis per day.)

It has also been brought to light during the two years' operation of this system that parts of the system need to be replaced as follows: Endless and hoisting ropes and button lines have had a life of about nine months, as have also the wheels of the overhead carriage. The removable rims of the endless drums are subject to wear and have a life of twelve to fifteen months, and controller contacts require renewal about once in the same time. This constitutes the sum total of the repairs so far found necessary.

In addition to the above apparatus there are installed on the platform or wharf in front of the warehouses, three two-ton steel stiff-leg derricks. These derricks are each operated by a three-drum Lidgerwood hoist driven by a 25-hp, 250-volt, direct-current, series-wound motor. These derricks are operated by the same class of labor as the cableways and are in constant service during the period of high water, when river steamers and lighters may reach the platform close to the warehouses. They have been in operation the same length of time as the cableways, and except for the renewal of hoisting ropes, have required absolutely no repairs.

The company up to the time of the present writing has constructed eight warehouses, all of which are supplied with double rows of incandescent lights. All exterior lighting is performed by 220-volt enclosed arcs, and about 40 of these are operated nightly. An adequate water supply is furnished from a steel tank holding 180 tons of water and supported at an elevation of 50 ft. above the ground by a steel tower. Water is supplied to this tank by means of two triplex double-acting Deane pumps driven by electric motors, one pump having a capacity of 90 gallons per minute and the other 320 gallons per minute. Both of these pumps are suspended on elevator cars, the cars running in hoist ways built up from the bed of the river. This is necessary on account of the rise and fall of the river. A single pipe system is used, the pump being connected in a by-pass to the main pipe; valves are placed in the main pipe at fixed heights and tees are provided above and below these valves for making connections to the suction and discharge of the pump.

The power house of the company consists of a steel and brick building 60 ft. square with a brick partition dividing the interior into two equal rooms. One room contains at present the boiler equip-

FIG. 2.—ELECTRIC DERRICK.

ment, which consists of two boilers of the locomotive type, each boiler having 1,000 sq. ft. of heating surface and 25 sq. ft. of grate surface. The boilers are 21 ft. long with shells 63 in. in diameter. They are constructed throughout of ⅜-in. steel of 60,000 pounds tensile strength, and the longitudinal steams are butt joints, double-strapped and riveted. Each boiler has a separate iron stack 30 in. in diameter by 60 ft. high. There is a separate injector for each boiler and a Worthington duplex feed pump is installed.

The engine room contains two 18 by 36 Allis-Chalmers 1890 model Corliss engines, one right-hand and the other left-hand. These engines operate non-condensing at a pressure of 90 pounds and run at 92 r.p.m. They have cast-iron fly-wheels 17 ft. in diameter and 26 in. face made in two pieces. These engines each drive by means of a belt a 150-kw, 250-volt Westinghouse direct-current generator. In addition to these two units there is also installed a 12 by 10 Harrisburg standard engine direct-connected to a 37½-kw, 250-volt, direct-current Westinghouse engine-type generator. This set is primarily used for operating the lighting load, but is also operated during the day at times when the load is such that a Corliss

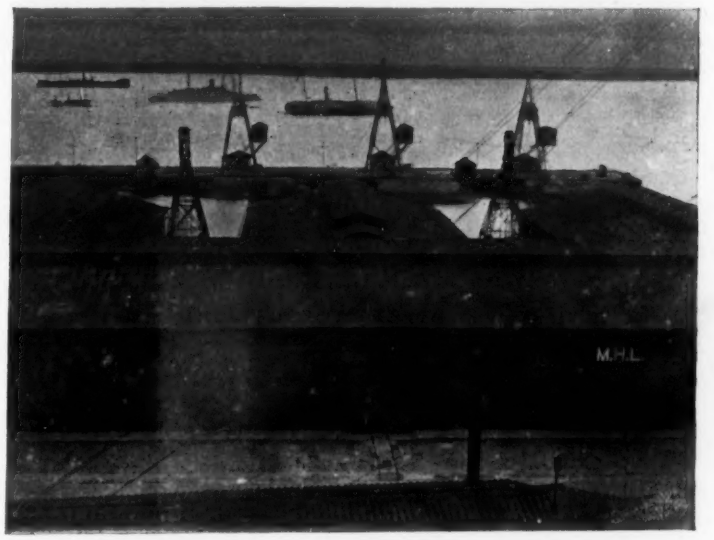


FIG. 3.—VIEW SHOWING THREE ELECTRIC CABLEWAYS.

engine is not required. The engine room also contains two Locke dumper regulators, one for each boiler and the switchboard, which consists of six panels, three generator panels and three feeder panels.

A novel feature in line construction may be noted in the feeder that runs from the power house to the cableway float. There are only two spans, one of 350 ft. and one of 550 ft. The feeder is of stranded aluminum, 650,000 c.m. in section, with triple-braid insulation. A half-inch steel cable is securely anchored to the foundation of the power house, passes over a heavy wooden A-frame and then to No. 1 shore tower of the cableways; from there it passes out over the river to the "head" tower of No. 2 cableway and is there securely anchored. This steel cable forms a support for the aluminum feeders, the positive and negative lines of which are suspended therefrom, one under the other, by means of iron links and moulded mica bell insulators. In addition to the above equipment the company has in operation a number of steam locomotive cranes and several steam-operated inclined planes, but the fact has been demonstrated clearly that the electrically-driven machines far surpass the steam ones at every point, and the writer understands that when the entire works are completed the steam machinery will be entirely displaced.

Aluminothermic Process.

According to A. Colani, in the *Comptes Rendus,* binary compounds of aluminum may be obtained by igniting a mixture of aluminum powder and a metalloid such as sulphur or phosphorus. He has carried this process further and has obtained binary compounds of other metals by reducing a metallic oxide with aluminum in the presence of a metalloid. In a magnesia-lined crucible he places a well-stirred and thoroughly dried mixture of the oxide and the aluminum powder in theoretical proportions, with the metalloid in excess if it is volatile. It is then ignited with a magnesium cartridge. The reaction is often violent. The metalloid may be replaced by its oxide, and reduced by the aluminum together with the metallic oxide. This is especially convenient in the case of arsenic or antimony, if the heat disengaged by the action of aluminum upon the metallic oxide is insufficient to melt the mass. In the case of silicon and boron, the preliminary preparation of these elements becomes unnecessary. Also, it is possible to add mixtures like $3CuO + 2Al$ or $3SnO_2 + 4Al$, and thus to attain temperatures which rival the electric furnace. The difficulty encountered is that of removing the metallic aluminum which remains uncombined. The author gives a number of examples, such as arsenides and phosphides of iron and uranium, and silicides and borides of copper and iron.

Regulation of Gas and Electric Rates in Massachusetts.—I.

By Alton D. Adams, LL.B.

MILLIONS of dollars have been taken from the earning capacity of gas and electric plants in Massachusetts by rates fixed in decisions of its Gas and Electric Light Commissioners during the past twenty years. This rate making has been done under a statute which provides that, upon complaint in writing of the mayor of a city or the selectmen of a town in which a gas or electric plant is located, or of twenty consumers supplied by such a plant, as to either the quality or price of the service, the Commissioners may order such reduction in price of gas or electricity, or improvement in the quality, as "they deem just and proper." Any court having jurisdiction in equity may, on application of the Commissioners, enforce their lawful orders. Under this delegation of authority by the Legislature, the only limit to the power of the Commissioners in fixing rates is the constitutional provision that property shall not be taken without due process of law. As to what rates are warranted by sound public policy, above those which courts will hold to be confiscatory, the Commissioners have a free hand.

In their decisions the Massachusetts Commissioners have enforced a law or policy as to rates that is quite distinct from what a court might make in deciding whether rates were confiscatory. New York has recently created a gas and electric commission with rate-making power, other states may be expected to follow this example at an early day, and the precedents set by the Massachusetts Commissioners tend to show what may be expected in other jurisdictions. The law or policy of the Massachusetts Commissioners is found in their decisions on gas and electric rates, in connection with the facts of each particular case. In the opinions announcing their decisions the Commissioners state only a few of the important facts bearing on each case, such as the ratio of net earnings to the capital employed, and the costs and prices of gas or electric service by the company concerned, or by others similarly situated. These facts are, however, before the Commissioners in the sworn annual reports of all the gas and electric companies of the state, and a knowledge of the facts is essential to an understanding of the principles involved in the decisions to which they relate.

The following collection of cases includes a few of the most important involving the question of gas rates, and all those on electric rates that have come before the Massachusetts Commissioners. Each case, as stated, is intended to contain the more important facts bearing on its determination, the decision of the Commissioners and the reasons given therefor, and any expressions of general policy that the Commissioners may have made. Statements of the law or policy of the Commissioners are here cited frequently in their own wards. Annual reports of gas and electric companies are made, in Massachusetts, for years ending June 30, and the financial data stated in each case are usually taken from the latest reports before the Commissioners at the time they made their decision. For the purpose of comparing costs and prices, companies under similar circumstances as to output and other factors have been selected, as far as possible. In each case the aim has been to select, for comparison with the company directly concerned, those whose costs or prices of output were as low as any that could be found, under approximately similar circumstances, as this is one of the ways in which the policy of the Commissioners is to be brought out. The rule followed in the statement of the cases has been to avoid all expressions of opinion save those of the Commissioners, and to add nothing in the way of discussion. Each case stands, therefore, on its groundwork of facts just as the Commissioners left it.

The earlier cases before the Commissioners related mostly to the price of gas, but in later years an increasing number of decisions have involved rates for electric service. A study of the opinions of the Commissioners, and of the facts to which they relate, shows that they have followed the same policy in fixing both gas and electric rates.

The total cost of gas, or of electric service to any company, as named in the cases, includes every expense incurred in the conduct of its business, except depreciation, and thus covers such items as management, legal fees, insurance and taxes. Neither interest nor dividend charges are covered by the sums given for cost or expense. Depreciation is not included in the costs named, except in so far as the charges made by the companies for repairs and renewals may offset shrinkage in plant, because no regular amounts or percentages are allowed for it in the reports, and the irregular charges that do appear under this head are inconclusive. Cases are arranged according to the years of decision.

1. Rate regulation by the commission began with a petition from Worcester, early in 1887. This petition was signed by 105 consumers and asked for lower gas rates and better service. At that time the Worcester Gas Light Company had a capital stock of $500,000, and no bonds or notes outstanding. Since its organization, in 1851, it had paid a 10 per cent. dividend in nearly every year, and for the year ending June 30, 1887, the dividend rate of the company was 9.5 per cent., amounting to $47,500. During that year the company sold 80,453,700 cu. ft. of mixed coal and water gas at the gross rate of 2.25, the net rate of 1.80, and the actual average rate of $1.82 per 1,000 cu. ft. The $47,500 paid in dividends for the year amounted to 59.04 cents per 1,000 ft. of gas sold, or to 32.4 per cent of the average price received for gas. Per 1,000 ft. of gas sold during the year ending June 30, 1887, the capital of the Worcester company was $6.21, and the sales of gas per capita amounted to 950 cu. ft., on the basis of the population of that city, in 1890, which was 84,655. In the same census year the Massachusetts cities nearest to Worcester in population were Lowell with 77,696, and Fall River with 74,398. Using these figures, the sales of gas at Lowell were 2,201 ft., and at Fall River 700 ft. per inhabitant, during the fiscal year ending at the middle of 1887. In the same year the stock and bonds of the Lowell company amounted to $2.92 and of the two companies in Fall River to $4.27 and $7.13, respectively, per 1,000 cu. ft. of gas sold. Though Worcester was the second city of the state in population, it was fourth in the volume of gas sold, and there were eight cities, in 1887, that had lower rates These cities and the net rate per 1,000 ft. of gas in each to ordinary consumer's were, Boston $1.40, Cambridge $1.75, Charlestown $1.75, Fall River $1.75, Lawrence $1.60, Lowell $1.20, New Bedford $1.50 and Taunton $1.65. Gas at Worcester average 17.93 cp., according to the official tests, but consumers claimed that there were great variations in candle power from day to day For all the coal and water gas plants of the state the average was 17.74 cp.

With these facts before them in the books and reports of the gas companies, if not in the evidence at the hearings, the commission reduced the net price of gas in Worcester to $1.50 per 1,000 cu. ft. In the course of its opinion on the case the commission said, in part:

"A reduction in price should be made, because the capital of the company is excessive for the output of gas and the value of its plant. It should be stated, however, that every dollar of stock has been paid in cash. The company has not improved its field for business to the extent that it might have done. . . . Worcester ought to consume two or three times the amount of gas that is now sold, and under a different policy would undoubtedly do so, and this increase in consumption would easily insure lower prices The company has a valuable franchise and is under obligations to make every reasonable effort to supply the citizens with all the gas required, and at a price consistent with a fair interest on the investment."

The net rate of $1.50 per 1,000 was put into effect by the company July 1, 1887, as directed by the commission. If this rate had been applied to the sales of gas during the twelve months ending on June 30, it would have reduced the amount applicable to dividends by 30 cents per 1,000 cu. ft. of gas, or by 50.8 per cent. of the sum paid as dividends in that year. This would have reduced the sum paid as dividends to 4.826 per cent of the capital stock. No account is taken in these figures of the increase of sales that would have resulted from the lower rate. During the year ending June 30, 1888, the sales of gas by the Worcester company increased 14 per cent. over those of the previous year. The income from gas and residuals exceeded the operating expenses by $44,470.77, and $30,000 were paid in dividends, which were 6 per cent. of the stock, and 32.71 cents per 1,000 cu. ft. of gas sold.

2. The South Boston Gas Light Company was one of the group of four Boston companies against each of which the mayor of that city, and gas consumers, brought petitions for a reduction in rates, during the year ending June 30, 1893 In their decision the commissioners fixed the net rate for gas sold by the South Boston company, on and after July 1, 1893, at $1.30 per 1,000 ft. Gas sup-

ply was carried on in South Boston. On June 30, 1892, the capital stock of the company was $440,000, and there was outstanding against it $25,000 in notes. During this year the company had an income from sales of gas and residual products of $133,699.69, its entire expense of operation was $82,079.34, and the excess of earnings was thus $51,620.35. From this last sum, interest to the amount of $1,461.10 was paid during the year, and the remaining $50,159.25, which might have been applied to dividends, represented 11.4 per cent. of the capital stock. Only 4 per cent. on the capital was actually paid in dividends, however, and this amounted to 23.61 cents per 1,000 ft. of gas sold. The gas sales had a volume of 74,531,793 cu. ft. during the year, and the capital and notes represented $6.24 per 1,000 cu. ft. of this volume. In price, South Boston gas was $1.70 gross, $1.50 net, and $1.52 average, per 1,000 cu. ft. during the year. After the sum received for residual products was deducted from the operating expenses, the total net cost of gas to the company was 82.8 cents per 1,000 cu. ft. sold in the year under consideration. This total was made up of a net cost of 53.61 cents in the holder, and 29.19 cents for distribution per 1,000 cu. ft. sold. If the rate of $1.30 per 1,000 had been in force on the sales of the year ending June 30, 1892, the net income of the South Boston company would have been reduced by about $14,906, or to $35,253, which represents 8 per cent. on the capital stock. The South Boston company in this year sold 2.4 million cu. ft. of gas per mile of main, and the average candle power of its gas tested at 17.8. During the same time the company in Haverhill sold a total of 52.8 million cu. ft., which amounted to 2.2 million cu. ft. per mile of main, and the average candle-power of this gas was 20.79. At Haverhill, the net price of gas was $1.40 per 1,000 cu. ft in this year. The Bay State Gas Company, which was controlled in common with the South Boston and other Boston gas companies by a foreign corporation, sold 883.2 million cu. ft. of gas during the year under consideration, and this gas cost the company 33.77 cents net in the holder. If the Bay State company had sold gas to the South Boston company at 43.77 cents per 1,000 cu. ft., the latter company could have sold at less than $1.30 per 1,000, and paid a 10 per cent. dividend.

In explanation of their decisions in the kindred Boston, South Boston, Roxbury, and Dorchester cases, the commissioners wrote only one opinion, in which it was pointed out that the companies were distinct persons in law, and must be so treated. The existing plants at Dorchester and Roxbury were not large enough to meet the demands in those territories, and could not supply the quality of gas that was being distributed. The prices fixed for the Roxbury, Dorchester and South Boston companies were said to be based on the assumption that these companies would continue to buy a part or all of their gas from the Bay State Company. Prices charged by the Bay State Company to the other gas companies were said to have been in excess of what was essential to a fair profit, and to have imposed an unjustifiable burden upon consumers. In the rates fixed for the companies that distributed gas, it was the intention to allow the Bay State Company to earn only a fair return on the actual investment in its business. It was stated that a fair and uniform price for gas throughout the city of Boston could only be had when it should be supplied by a single corporation in law and fact. The large profits of the Bay State Company had been derived mainly from the old central part of Boston, where nearly five times as much gas was distributed per mile of main as in the suburbs, and there the greatest reduction in price must be made. Even if the Roxburg, Dorchester and South Boston companies bought their gas at a fair price, they could not sell it at as low a rate as the Boston company.

As to the obligations of public service companies the commissioners said: "The Board has always taken the position that companies which have received from the public as a free gift extensive and valuable privileges by the exercise of which alone their profits became possible, are bound to return to the public the most efficient service at the lowest prices consistent with a fair profit, and for this purpose to avail themselves of all reasonable facilities and expedients known to the business in which they are engaged. If by reason of superior skill in management, or by the existence of a common control in companies supplying contiguous territories, special economies become available, while the corporation which secures these results is entitled to a liberal reward, the public should also receive, as a matter of sound business policy, some share in the benefits thus made possible."

New Telephone Patents.

EXCHANGE SYSTEM.

The circuit of an exchange system is shown in Fig. 1, which is remarkable for the simplicity of its cord circuit. It will (from reference to Fig. 1) be seen that the signal apparatus of this has been reduced to a remarkable minimum. The practicability of this simple cord circuit depends solely upon the cut-off relay and its novel location in the circuit. It will be seen that not only does the cut-off relay clear the line of the line signal apparatus, but in

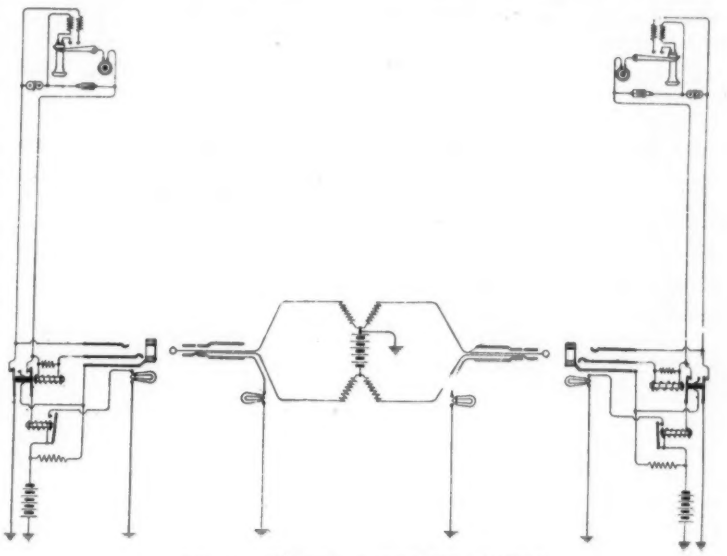


FIG. 1.—M'BERTY EXCHANGE SYSTEM.

addition it controls the shunt of the supervisory lamp through its auxiliary contact. At first sight it looks as though the line lamp would follow the hook switch, but it must be remembered that the cut-off relay only releases when the receiver at the station is on the hook, the condition for a non-actuated line relay. Mr. F. R. McBerty, of Chicago, is the inventor of this system.

SELECTIVE CALL SIGNAL.

With some systems of operating it becomes necessary for a receiving or distributing operator to forward a call to any one of a number of connecting operators, and it becomes a problem to effi-

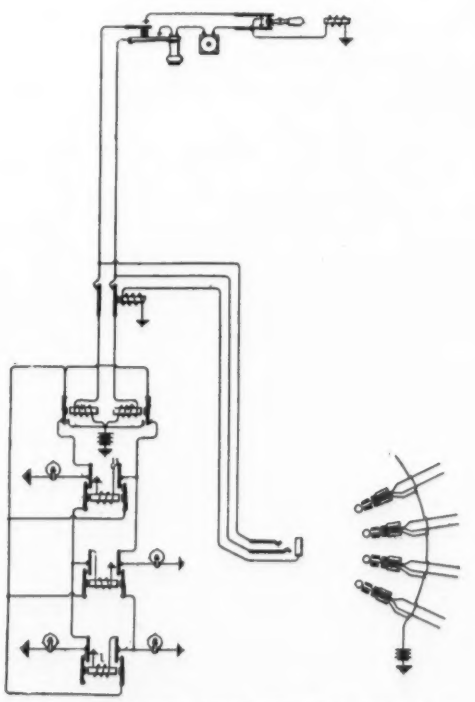


FIG. 2.—M'BERTY SELECTIVE CALL SIGNAL.

ciently notify the proper operator of the particular line upon which she is desired. Calling circuits and auxiliary trunks have heretofore been largely used. Mr. F. R. McBerty has obtained a patent for a selective lamp call by which the distributing operator may readily

signal the desired operator, the signal being directly associated with the line demanding attention. Fig. 2 shows the circuit. If the distributing operator throws her key up once to the right she causes the lighting of the upper left-hand lamp of the calling group. A stroke up, followed quickly by one down, lights the upper right-hand lamp alone. Similarly a quick double stroke followed by an up-stroke lights the third lamp and, two doubles, the fourth lamp. The answering of any operator restores all relays to normal by cutting off the battery supply.

SERVICE METER.

Mr. C. E. Scribner has patented a so-called automatic service meter or call register. This is associated with the circuit of a subscriber's line so that the act of calling begins the count while the act of response by the operator completes it. It has been found that this general type, namely, the automatic, is not very practicable. This patent of Mr. Scribner, as well as the two preceding, have been assigned to the Western Electric Co.

TELEPHONE TELLTALE.

A rather novel use of the telephone is that of telltale for an annunciator system, described in a patent issued to S. B. Bankson, of San Francisco. The telephone is wired in the battery line and the vibrating of a distant bell is noted by the noise. The ringer knows the bell sounds by this means.

PHOTOPHONE.

Although the photophone was invented many years ago, it has never been brought to practical service. From time to time improvements have been made, but it has been possible to transmit speech over but a short distance, even with all known appliances used. Mr. B. Saenger, of Berlin, Germany, states that this is due to the fact that it has been impossible with the parabolic mirror used to sufficiently concentrate the beam of light, and he has patented a selenium cell photophone wherein, by means of lenses and a diaphragm, he concentrates his whole beam of light upon the receiving cell.

SWITCHBOARD CIRCUITS.

This week brings forth three patents for switchboard circuits. Mr. E. R. Corwin, of Chicago, the patentee of one of these, has gone upon the principle that with the common-battery system, with lamp supervisories, it is unnecessary for the operator to listen in. He therefore arranges his cord circuit so that one or both of the supervisory relays must be de-energized for the operator to listen in. This condition arises only when one or both stations has the receiver hung up.

E. E. Reis, of New York City, the inventor of the second system, has developed his system with one supervisory lamp responsive to both hooks and he has combined this with an automatic switching device contained within the sub-station receiver. This is so designed that it is, so to speak, impossible to leave the receiver off the hook.

H. G. Webster's improvements relate to the two-wire common-battery system, and he has devised a large number of various al-

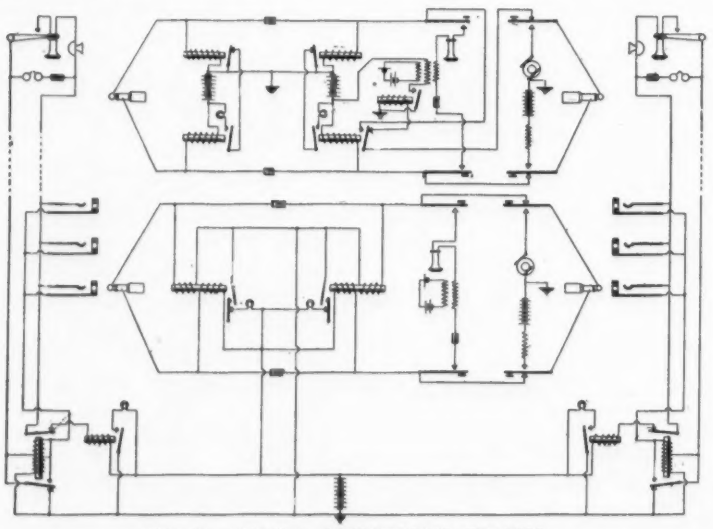


FIG. 3.—WEBSTER SWITCHBOARD CIRCUITS.

ternative circuits, all accomplishing a surer operation of the signals than has existed in many systems. Fig. 3 shows two of his cord circuits and one line circuit. The feature of these circuits is the cut-off relay, which is so constructed that the energizing winding included in the line circuit before answer is cut out of circuit by the answering operator, a shunt-circuit being substituted. Mr. Webster has assigned his patent to M. G. Kellogg, of Chicago.

CUT-OUT.

A porcelain base cut-out for telephones, the invention of J. A. Tornquist, of Clinton, Iowa, is shown in Fig. 4. The apparatus comprises mica-mounted fuses, a knife switch, a plug switch, a saw-tooth protector and a carbon plate protector. All are evident

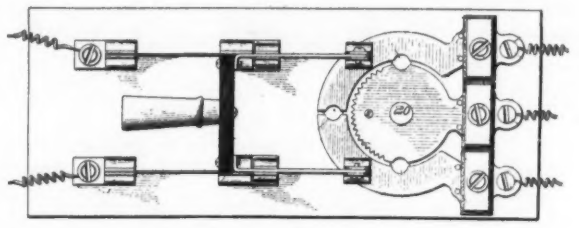


FIG. 4.—TORNQUIST CUT-OUT.

from the cut, but the last, the blocks of which are shown in plan at the right-hand end. One block rests under each of the two outside clamping plates and the third, the ground block, with ends exposed to those of the line blocks just mentioned, is beneath the middle plate.

SELECTING SYSTEM.

A. D. Neal, of South Boston, Mass., has patented a system for selecting any one or more of a number of circuits branching from a main circuit at a distant point. Control is effected by a combination of polarized and non-polarized relays. With three main lines three polarized relays, one associated with each, and three ordinary relays, one associated with each main, and using current reversals and currents of two strengths, sixty-four branch circuits may be brought under control.

LETTERS TO THE EDITORS.

Self-Excited Alternators.

To the Editors of Electrical World and Engineer:

SIRS:—Referring to the paper presented by Mr. William Stanley at the Asheville meeting of the American Institute of Electrical Engineers, and of which you published an abstract in your issue of June 24, page 1183, I wish to observe that the author is perfectly correct in the statement that the armature reaction is nullified in non-synchronous alternators. But he does not state that this is true only in case a machine is operating at unity power factor. An article which clearly demonstrates this fact and which treats of the same method of auto-excitation of alternators was contributed by me in 1901 to the *Elektrotechnische Zeitschrift,* December 12, page 1022.

When the machine is under an inductive load a component of the armature reaction enters into play. A power factor slightly less than unity, such as is common in many lighting plants, produces a fall in e.m.f., and if the alternator is self-excited it drops the load.

Another disadvantage resides in the fact that non-synchronous alternators cost more than synchronous machines, since for equal losses the weight of field copper is four times greater in the former than in the latter. (See *Elektrotechnische Zeitschrift,* December 17, 1903, page 1037.) To neutralize the armature reaction, it is preferable to employ compound-wound alternators, and preferably compound, self-exciting, synchronous alternators, as is done in many European installations. These machines cost in some cases less than ordinary alternators excited by direct current.

BRUSSELS, BELGIUM. A. HEYLAND.

Single-Phase vs. Polyphase Traction.

To the Editors of Electrical World and Engineer:

SIRS:—In an article in the *Electric Journal,* abstracted in your issue of July 8, Mr. C. F. Scott, after reviewing statements made by various engineers during the last few years, reaches the following conclusions:

1. That the use of single-phase, alternating current is essential for heavy and long-distance railway service.

2. That a single-phase motor and a single-phase system fulfilling the ideal requirements have been developed; and,

3. That engineers all over the world are substantially agreed that one form of motor, namely the series-compensated, single-phase motor, is the motor best adapted to meet the demands in heavy railway traction.

Mr. Scott does not put this forward as his own personal view in the matter, but rather as, what he calls "a legitimate conclusion from the statements" made by the engineers named. But, granted even that Mr. Scott is justified in drawing the above conclusions from the selected statements given in his article—which is not readily apparent—with what right can he claim that engineers all over the world are substantially agreed upon the points he makes?

I am voicing the opinion of a great many engineers, both here and in Europe, who hold that exactly the reverse is true, namely:

1. That single-phase alternating current is not at all essential for heavy and long-distance railway service.

2. That no single-phase motor and single-phase system has yet been developed which fulfills the ideal requirements; and,

3. That there are several forms of alternating-current motor better adapted to meet the demands of heavy traction than the series-compensated, single-phase motor.

It is only necessary to look at actual facts to see that our view has at least the same chance of being correct, as has that of Mr. Scott. Let us consider Mr. Scott's conclusions in their order:

1. The principal desideratum in heavy and long-distance railway work is a comparatively high pressure in the contact line. But this can be obtained in various ways other than by the use of single-phase alternating current. Perhaps in eliminating the three-phase system entirely, Mr. Scott laid great stress on the difficulties connected with the second overhead conductor of that system. If he does he certainly overestimates those difficulties. At all events, the only heavy and long-distance railroads thus far electrified are being successfully operated by the use of three-phase alternating currents, and not a single road deserving the adjective "heavy" is using single-phase currents. The latter are, therefore, certainly not essential for this purpose.

2. It would, of course, be necessary to know exactly what Mr. Scott means by ideal requirements, in order to answer him accurately. But the fact remains that the very best single-phase motor yet produced has a considerably lower efficiency than any other type of railway motor; its starting torque is poorer, its weight much greater for the same output, and it is restricted to a very low pressure at the terminals—certainly none of these points speaks in its favor. Add to this the fact that it has not yet been produced in large sizes, so that a number of motors distributed in two or more locomotives are necessary to get any really important output, it seems obvious that the ideal has not yet been reached.

3. Had Mr. Scott restricted himself to claiming superiority for "long-distance" service and interpreted this as meaning long interurban lines operating single cars over both city streets and the open country, his case would have been a little stronger. But he distinctly says "heavy and long-distance" service and repeats the "heavy," so that he certainly must have in view steam railroad conditions. And for these there is at least one motor better suited than the single-phase compensated series motor. Those who have followed the discussions of this subject at the general meeting of the American Institute of Electrical Engineers in 1902 and at the recent Asheville meeting of the same body, will understand why I believe the three-phase motor to be distinctly superior for this class of service, nor am I the only one who is of this opinion. The reasons for our belief were there stated in detail, the principal factors being greater efficiency and lower cost, combined with certain technical features which will often be of very decided advantage.

Now, to put the matter in contention on a basis promising some definite result, allow me to make the following suggestion:

If Mr. Scott will make his own choice among the railroads fairly representative of the average American line with really heavy traffic, and if he will work out a project for this road based on the use of single-phase alternating currents and submit the results in an article in the ELECTRICAL WORLD AND ENGINEER or in a paper before the American Institute of Electrical Engineers in sufficient detail to show exactly what he is offering, I will then work out a project for the same road based on the use of three-phase alternating currents and submit my data in the same way, leaving it to the technical world in general to draw its own conclusions on this subject.

NEW YORK CITY. C. L. DE MURALT.

DIGEST OF CURRENT ELECTRICAL LITERATURE

DYNAMOS, MOTORS AND TRANSFORMERS.

Single-Phase Motor.—A description of a new motor of Lundell from an English patent specification. It combines "the principles which govern the operation of a series-wound motor and those which govern the rotation of a partly short-circuited armature which is caused to rotate by the secondary or the induced currents in the short-circuited coils." In Fig. 1 $L\,L'$ is a single-phase supply.

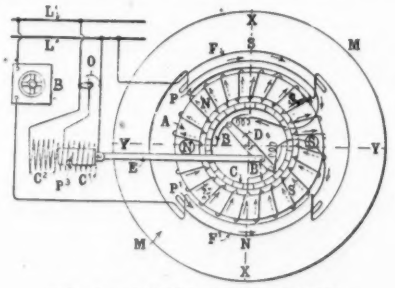


FIG. 1.—SINGLE-PHASE MOTOR.

M is the laminated field magnet with the two poles, $P\,P'$, and field windings, $F\,F'$. A is a Gramme armature and C the commutator. $B\,B'$ are brushes insulated from each other and wide enough to connect a number of commutator bars and coils. The position of these brushes is regulated by the rocker arm, D, which is connected by the rod E to the plunger, P^3, in the solenoid coils, C^1C^2. The switch, O, short-circuits one or the other of these coils and when opened puts both coils in circuit. (The coils C^1C^2 are preferably operated not from $L\,L^1$, but from a direct-current supply.) By means of the switch, O, the motor may be quickly reversed from a distance. R is a starting rheostat. The direction of the current is indicated by arrows which are shown in full if they pertain to the primary circuit and dotted if they pertain to the induced currents; the polarities, $S\,N$, are likewise indicated. The combined polarities of the primary and secondary currents will be located on the line $Y\,Y'$, and indicated by the letters S and N within small circles. "This is exactly where the polarities should be located in order to produce the best torque effects and the best efficiency. . . . By this invention it is proposed to reduce the secondary or the induced current in any one coil to a normal amount by short-circuiting such a number of coils that the combined ampere-turns from the short-circuited portions of the armature will nearly equal the ampere-turns on the other portions of the armature which are due to the primary currents. It will be seen that the induced and the primary currents in the armature winding are in the same direction at the leaving edges of the contact blocks, B and B' (at line $X\,X$ in Fig. 1). If these currents are nearly equal it follows that there will be no sparking as the commutator segments leave the brushes because of the fact that there will be no reversal or change in the current in the armature windings at these particular points.—Lond. *Elec.*, July 14.

Direct-Current Motors.—DUBOIS.—The first part of an article on various applications of direct-current motors, with special reference to starting and braking. The author first discusses the starting of a direct-current motor under load and shows how to calculate the different steps of the starting rheostat, a numerical example being given. The author then deals with the starting of centrifugal pumps and ventilators, in which at the start the energy is consumed to supply the losses due to friction and agitation of the liquid only; later on the energy consumption increases as the third power of the speed. Calculations are given for a shunt motor.—*L'Industrie Elec.*, July 25.

Lights and Lighting.

Electric Arc.—Dyke.—An account of experiments on the flux of light from the electric arc with varying power supply. The author determined a series of curves for both continuous and alternating-current arcs, showing the relation between the mean spherical candle-power and the watts taken up in the arc. This relation follows a straight-line law. This straight line, however, does not pass through the origin, but for zero candle-power there is still an outstanding amount of power amounting to some 200 to 400 watts. The amount of this power increases in general with the arc length, and is probably due to the energy dissipated as heat by radiation, and as chemical energy in evaporation of the carbon at the crater. For lengths of arc greater than ⅛ in., the ratio of the efficiencies of the continuous and alternating arcs is about 3 to 2. If the arc be made shorter than ⅛ in. the consumption line for the alternating-current arc gradually approaches the line for the continuous-current arc until for an arc length of 3/32 in. they are practically coincident. The arc is quite stable at this point, and even in the alternating-current case may be supplied at more than 600 watts without causing hissing. Any further decrease in the arc length will result in the alternating-current consumption line rising above the continuous-current line, although the alternating-current arc now begins to hiss badly. —*Phil. Mag.*, August.

Mercury Vapor Lamp.—Mareschal.—A description of the Heraeus mercury-vapor lamp, made from fused quartz for photographic purposes. The quartz permits the passage of the ultra-violet rays, which are extremely active for photographic work. The lamp is shown in Fig. 2, *V* being the tube of fused quartz, connected at

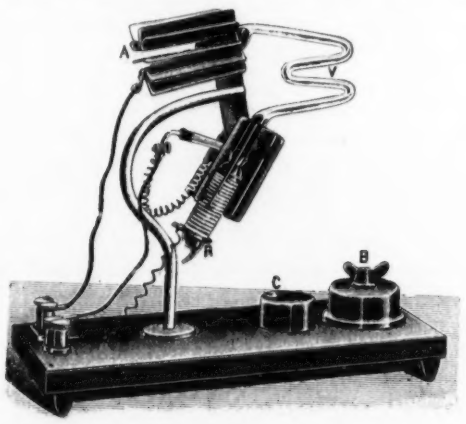


FIG. 2.—MERCURY VAPOR LAMP.

both ends to reservoirs *A* and *R*, filled with mercury. *A* is provided with a cooling device, while *R* is surrounded by a heating platinum wire. When the circuit is closed by means of the button, *B*, the platinum wire is connected to the circuit and gets heated. This has the effect that the mercury in *R* expands and gradually fills the quartz tube, *V*, until it reaches the mercury in *A*. Now the automatic commutator, *C*, disconnects the heating wire around *R* from the circuit, the mercury contracts again and the arc is started.—*La Nature*, July 15.

Singing Arc.—Blondel.—A full discussion of the properties of the singing arc with reproduction of very different wave forms obtained with different dimensions of the arc.—*L'Eclairage Elec.*, July 15 and 22.

Power.

Power Plant Design.—Koester.—The first part of a serial on modern power plant design and economics, with special reference to the differences in American and European practice. In the present installment the author discusses the general features of the design of large power plants. In continental Europe power plant designing is a vocation of itself, while this is not the case in this country. He thinks that this has to do with the fact that in a modern plant in continental Europe a steam consumption of only 9 to 10 pounds per indicated horse-power is obtained, while in England and America a consumption of 13 to 15 pounds is considered good practice. The modern tendency is now toward very large single stations, and also toward very large generating sets. The most favorable arrangement of the location of the engine room and boiler room has been found to be side by side, thus allowing in most cases the shortest steam pipe runs. With the adoption of the steam turbine as the prime-mover making a compact layout, the turbine room is much smaller than the boiler room, provided the much-used horizontal water-tube boilers are installed. It is probable that the compactness of the turbine will create a revolution in the design of the boiler house, introducing into more general use the vertical type of boiler. Some notes are given on steel construction of power plants. The article is profusely illustrated.—*Eng. Mag.*, August.

Electric Power for Canals.—Kronstein.—The Austrian Department of Commerce arranged last year an international competition for equipping a hoisting plant in connection with the Danube-Oder Canal, the difference of level being 36 meters. The electric equipment is one of the projects which received the prize. It is described and illustrated in detail.—*Zeit. f. Elek.* (Vienna), July 30.

Hydro-Electric Power Station.—Galloway.—A profusely-illustrated description of the hydro-electric power station of the California Gas & Electric Corporation, at De Sabla, Cal. The station contained formerly two 2,000-kw generators, while recently a third generator of 5,000 kw capacity has been installed which is run by a single water wheel operating under a static head of water of 1,528 ft. All are 60-cycle, three-phase, 2,300-volt machines. The transmission line is of aluminum.—*Eng. News*, August 10.

Furnace Charging.—An illustrated description of electrically-operated machines for charging open-hearth furnaces.—Lond. *Elec.*, July 14.

Steam Turbines versus Steam Engines.—Two articles discussing their relative advantages. The first article is in favor of the steam engine, the second in favor of the steam turbine.—*L'Industrie Elec.*, June 10, July 25.

Traction.

Street and Elevated Railway Statistics in the United States.—The annual statistical table on street and elevated railway mileage, cars and capitalization in the United States and Canada. Figures are also given for our insular possessions and Cuba. For the United States alone the total number of roads was 993. The electric railways had a track mileage of 29,548, the cable, steam and horse railways one of 639; total, 30,187 miles. The capital stock in 1904 was $1,761,571,812 (an increase of $68,181,514 against 1903); the funded debt, $1,455,520,159 (increase $66,055,810); the capital liabilities, $3,217,091,971 (increase $134,839,324, or 4.4 per cent.).—*St. R'y Jour.*, August 5.

Electrolysis Due to Tramway Return Currents.—An account of experiments made in Germany, especially in Strassburg and Dresden. The work consisted mostly in potential measurements. No practical conclusions are drawn.—*Eng. Record*, August 5.

Freight Automobile.—A detailed illustrated description of the "couple gear electric truck."—*Iron Age*, August 10.

Wires, Wiring and Conduits.

Temporary Wiring.—An illustrated description of a method of temporary wiring, especially designed to avoid fire risk and the liability of electric shock. Special tinned copper wire with rubber insulation is enclosed in a flexible steel tube, which is fire-proof and water-proof. Suitable lengths are made up, and a mechanical coupling is fixed on each end so that any desired length of run can be effected, and fittings connected wherever necessary. One advantage is that the tubing forms a continuously-connected metallic conductor, so that accidental shock is impossible. The coupling is shown in Fig. 3. The case is of brass, turned out of the solid rod and divided

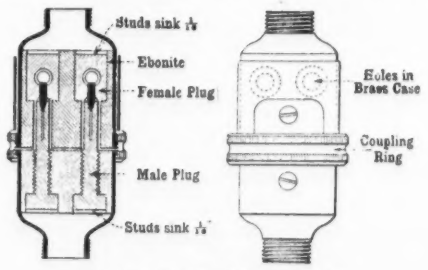


FIG. 3.—TEMPORARY WIRING.

into two parts connected by a screwed and milled ring. The insulating material is ebonite and the plugs are of brass. "Each female plug is provided with a small tapered pin which enters a split hole in the male plug, thus spreading out the latter when it is home, and pressing it against the sides of the interior of the female plug. This insures an increased area of contact and conse-

quently an enhanced carrying capacity. One-half of the coupling is provided with a sleeve, held in position by the projecting head of a spring pin, and this sleeve serves to cover an additional pair of plug holes in the brass case. When the sleeve is raised a plug can be inserted and a connection taken off at right angles.—Lond. *Elec.*, July 14.

ELECTROPHYSICS AND MAGNETISM.

Radium.—RUTHERFORD.—An account of an experimental investigation on the charge carried by the alpha and beta rays of radium. The total number of alpha particles expelled per second from one gram of radium at its minimum activity is 6.2×10^{10}. The total number of alpha particles expelled from radium in radioactive equilibrium is four times this figure and equals 2.5×10^{11}. The alpha particles are positively charged at the moment of their expulsion. The total number of beta particles expelled from one gram of radium per second is 7.3×10^{10}. From these figures the author calculates some physical constants of importance in radioactivity. The average life of radium is 1,850 years. The heating effect of radium and of its various products is due to the bombardment of the alpha particles expelled from them. The emission of energy in the form of kinetic energy of the alpha particles is 126 gram-calories per gram per hour. With respect to the number of ions produced, the alpha particle has a somewhat larger sphere of action than the electron, and is able to ionize about two molecules for the electron's one.—*Phil. Mag.*, August.

Recombination of Ions in Gases.—RICHARDSON.—A paper in which the author attempts to explain the variation of the rate of recombination of ions formed in gases with the pressure of the gas. The hypothesis that recombination takes place only after the kinetic energy of the ions has been reduced by collision with neutral molecules, when the ions are very near each other, affords a satisfactory explanation of the variation of the rate of recombination with the gas pressure. The results indicate that practically every ion which makes a collision with four molecules becomes fixed; that most of those which make only three, and about one-sixth of those which make only two, collisions, recombine. The terms with fewer collisions become more important at lower pressures. The quantity obtained by dividing the coefficient of recombination by the sum of the velocities of the two kinds of ions, when expressed as a function of the pressure, depends, in the cases of different gases, on a single parameter, which is the mean free path of an ion in the gas in question at some definite pressure. An ion in carbon dioxide at high pressures probably contains the same number of gas molecules as an ion in air.—*Phil. Mag.*, August.

Magnetic Effect of Electric Displacement.—WHITEHEAD.—An account of an experiment which was devised to prove directly the magnetic effect of electric displacements, the arrangement being shown in Fig. 4. If a portion of dielectric be subjected to an alternating

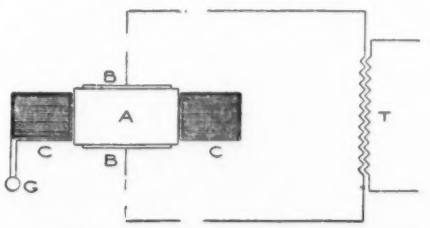


FIG. 4.—MAGNETIC EFFECT OF ELECTRIC DISPLACEMENT.

electric intensity, alternating displacement currents will be set up in the dielectric. If now the dielectric be properly surrounded by a magnetic circuit, alternating magnetic induction will be set up therein, and if this circuit be wound with a number of turns of wire, an alternating e.m.f. will be induced therein, and this e.m.f. may set up a current. The value of the current may be calculated and measured. As constructed the dielectric was a cylinder, *A*, of paraffin. The e.m.f. was applied to electrodes *B* consisting of circular brass plates on the end faces of the cylinder. Concentric with the cylinder and surrounding it was the laminated magnetic circuit, *C*, consisting of soft iron discs; the iron ring thus formed was wound with what may be called the secondary winding, in circuit with which the measuring instrument, *G*, was connected. The observed effect was of the same order of magnitude as that calculated. —*Phys. Rev.*, August.

Magneto-Optics.—WOOD.—An abstract of a British Physical Society paper, in which he discussed the magneto-optics of sodium vapor for light traveling along the lines of force.—Lond. *Elec.*, July 14.

Electrical Vibrations.—NICHOLSON.—A mathematical paper on electrical vibrations between confocal elliptic cylinders, with special reference to short waves.—*Phil. Mag.*, August.

ELECTROCHEMISTRY AND BATTERIES.

Industrial Resistance Furnaces.—FITZGERALD.—An illustrated article discussing the furnaces of Gin, Colby & Kjellin. The author gives the calculation of the Gin furnace and describes some recent improvements in its design. In the same issue there is a very full account of a report by Engelhardt, who studied the Kjellin furnace in actual operation last year in Sweden. In his conclusions he states that in comparison with the crucible steel furnace, the Kjellin furnace produces a steel equal in quality to crucible steel, and is able to furnish it at a lower cost. He also thinks that the electric induction furnaces can compete successfully with the open hearth furnace for making structural steel as long as the kilowatt-hour does not cost more than 0.5 cent.—*Electrochem. and Met. Ind.*, August.

Raw Materials for Electrochemical Industries of Niagara.—GREEN. —An article giving the sources of supply of the chief materials used in the electrochemical industries of Niagara Falls. The most convenient sources and the cost of the following materials are discussed in detail: Salt for making caustic and chlorine in the Acker and Castner processes; coke, for the graphite, carborundum, siloxicon and carbide industries; pure glass sand, used for graphite, siloxicon and carbon; anthracite for making graphite; and lime for bleaching powder and calcium carbide.—*Electrochem. and Met. Ind.*, August.

Chemical and Electrical Energy.—HABER.—A paper discussing the development of the fundamental formulas of chemical and electrical energy. As the first stage of the development he considers the view according to which the electrical energy generated in a cell is exactly equal to the energy of reaction. This view leads to Thomson's rule, but was later modified by Helmholtz, who showed that at the right hand of Thomson's rule a second term must be added corresponding to the tendency of the cell to heat or cool during discharge. This second term is proportional to the temperature coefficient of the e.m.f. Van't Hoff has then given another formula for the e.m.f. as function of the temperature and of the concentrations of the ions formed and consumed respectively during the reaction. The numerous investigations which were undertaken to conform by experiments the formulas of Helmholtz and van't Hoff are considered the second stage in the development, while the third stage relates to some questions arising from a comparison of these two formulæ. The author shows that it is possible to calculate the equilibrium constant of the reaction from the reaction heat, the temperature and the difference of the specific heats of the substances formed and decomposed during the reaction. The paper is chiefly mathematical.—*Electrochem. and Met. Ind.*, August.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Measuring of Low Resistances.—WILD.—A description of a method of comparing two low resistances, the arrangement of which is

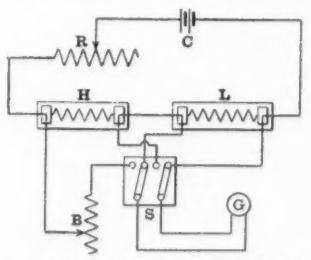


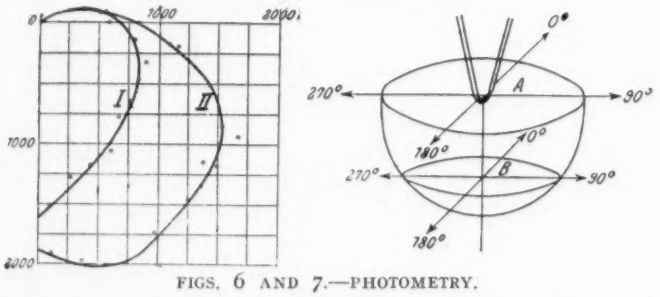
FIG. 5.—MEASURING LOW RESISTANCES.

shown in Fig. 5, where *C* is a battery of two or three storage cells, *R* a resistance for regulating the current, *H* the higher and *L* the lower of the two low resistances to be compared, *B* a Wheatstone bridge, *S* a two-way, double-pole switch, and *G* a sensitive moving-coil galvanometer, with mirror and scale. The actual resistance of the galvanometer is first measured at the temperature at which it is to be used. *S* is then switched over to the right and *R* regulated so that a convenient deflection may be obtained on the galvanometer scale. *S* is then switched over to the left, and then *B* is regulated till the same deflection is obtained as at first. If an accuracy of 1 in 500 is sufficient the test is finished. For greater accuracies, the procedure is as follows: The torsion head the galvanometer is turned

until the mirror looks out at an angle of about 90 degrees from the direction of the scale. The current should now be increased till the spot of light comes on to about the center of the scale. On switching over *S* it will now be perceived that there is a slight difference in the deflection obtained. *B* should be again adjusted till this difference of deflection disappears. The test is now finished. If the scale is about 8 ft. from the galvanometer, the difference of deflection corresponding to an error of 1 in 10,000 between *H* and *L* will be 0.015 in. The ratio of *H* to *L* equals that of *G* plus *B* to *G*. With a galvanometer having a resistance of 300 ohms and a bridge box going up to 30,000 ohms, two low resistances may be compared, having a ratio of 100 to 1. If the galvanometer is shunted, it is quite possible to compare resistances with a ratio of as much as 1,000 to 1. The advantages claimed for this method are the comparatively small current required to be passed through the resistances under test, the high degree of accuracy obtainable and the ease with which the comparisons can be made.—Lond. *Elec.*, July 14.

Testing the Magnetic Properties of Sheet Iron.—The following rules have been adopted by the German Association of Electrical Engineers: The total loss in iron is determined by means of a wattmeter in samples of at least 10 kg., taken from at least four sheets. The total loss is given for *B* maximum 10,000 and 50 periods per second, in watts per kilogram at a certain temperature. This fixture referring to sinusoidal voltage curves is called the loss figure ("Verlustziffer".. A standard thicknesses of sheet iron 0.3 and 0.5 mm. are considered. No variation of thickness by more than 10 per cent. is permitted. For the test a magnetic circuit is used which contains only iron of the quality to be tested. The specific gravity of iron is assumed to be 7.77. The "ageing coefficient" is the change in per cent. of the loss figure after 600 hours of heating to 100° C. The apparatus of Epstein, Moellinger and Richter are considered to be suitable for the tests.—*Elek. Zeit.*, July 27.

Photometry of Non-Symmetric Sources of Light.—BLOCH.—The photometry of non-symmetric sources of light is generally considered to be complicated. It is possible to get with a single measurement the total illumination with the aid of either the lumenmeter of Blondell or the sphere photometer of Ulbricht. But these instruments are not yet in general use, since they are either too complicated or their simplified designs have not yet proven reliable in practical use. The present author shows that even sources of light with a great lack of symmetry can be tested in the ordinary way with only a few additional measurements. He describes a test of an arc lamp with inclined carbons (Fig. 7) of 10 and 7 mm. diameter. The thicker carbon lagged in burning off behind the thinner one, so that the distribution of light was very unsymmetric. He first determined the distribution of light from the arc with and without a globe in a vertical plane perpendicular to the plane through the carbons. Curve *I* in Fig. 6 was taken with globe, *II* without globe.



FIGS. 6 AND 7.—PHOTOMETRY.

The figures mean, of course, candles. These curves show that they cannot give any correct idea of the total illumination from the lamp, since otherwise the globe would absorb about 40 per cent. of the light, which would be extremely high. The author then determined the distribution of light in horizontal direction, in the two directions *A* and *B*, in Fig. 7. In each case 8 points were determined and from these the polar diagrams of Fig. 8 were plotted, the left hand diagram referring to the lamp without globe. It will be found that the average of 16 values is almost the same as the average of only 4 values, relating to points displaced from each other by 90°.

	Without globe.		With globe.	
	Curve A.	Curve B.	Curve A.	Curve B.
L_1 average of 16 values.....	640	1260	520	1030
L_1 average of 4 values.....	660	1300	525	1040
L_0	900	1860	530	1050
$k = \frac{L \text{ average}}{L_0}$	0.71	0.68	0.98	0.98

From the averages of *L* and from the values of L_0 taken from the curves Fig. 8 in the direction of *O*° (the same as Fig. 6) the reduction factor $\frac{L \text{ average}}{L_0}$ is calculated, which refers to *A* and *B* respectively. It will now be seen that this reduction factor is almost the same for *A* and *B*, so that its mean value may be assumed to be correct for the whole vertical plane in the direction *O*°. This factor is 0.695 for the lamp without globe and 0.98 for the lamp with globe. If we determined by the usual methods the

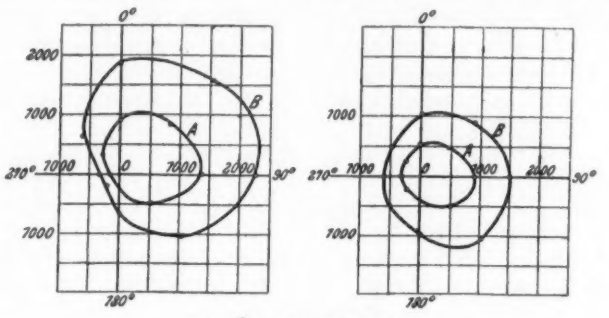


FIG. 8.—PHOTOMETRY.

mean hemispherical intensities from the curves of Fig. 6, we have to multiply these values with the above reduction factors, to get the correct values for the whole lamp. We thus get without globe 0.695 × 1,620 = 1,130 candles. And with globe 0.98 × 980 = 960 candles mean hemispherical intensity. This gives an absorption of 15 per cent., which agrees with other tests.—*Elek. Zeit.*, July 13.

Thermo-Electric Measurements of Temperature.—PALMER.—An account of measurements in which he used a couple of iron and "advance" wire. This is the trade name of a wire, which contains approximately 55 per cent. copper, 44.4 per cent. nickel and 0.6 per cent. iron. This results show that temperatures in the interval from 0 to 200° C. can be determined within one twenty-fifth of one per cent., with the iron-advanced thermo-element when the residual thermo-electric effects are suitably eliminated.—*Phys. Rev.*, August.

Comparison of Electric Fields.—OWEN.—An abstract of a (Brit.) Physical Society paper describing experiments in which an "electric needle" is used to measure electric fields in a manner similar to that in which a magnetic field is measured by an oscillating magnetic needle. The needles are cylindrical in form, of aluminum or brass, suspended by quartz fibres. The couple on the needle when disturbed from the direction of the field is proportional to the square of the field strength. For small displacements the needle vibrates isochronously, the frequency being proportional to the electric force. It may be used in alternating as well as in steady fields, and may be applied to illustrate many of the laws of electro-statics.—Lond. *Elec.*, July 14.

Motor Meter.—A fully illustrated description of direct-current motor meters made by Mix and Genest, and admitted by the Reichsanstalt for calibration. The meter consists essentially of a motor free from iron, while the magnetic brake is rigidly connected with its axle. A shunt current produced by the supply voltage passes through the armature, while the supply current passes through the stationary field coils. The speed of the meter armature is proportional to the electric power consumed within the meter if the friction resistances are negligible. The construction is described and illustrated in detail. *Elek. Zeit.*, June 29.

Differential Ballistic Galvanometer.—RAYMOND.—A detailed description of various methods of using the differential ballistic galvanometer for determining self-inductances, mutual inductances and capacity. Some of these are zero methods, while others require the measurement of ballistic deflections of the needle of the galvanomter.—*Phys. Rev.*, August.

Oscillograph.—HORNAUER.—A description of the construction of the oscillograph of Siemens & Halske Co. Various curves taken with this instrument are reproduced.—*Zeit f. Elek.* (Vienna), July 16, 23.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Coherer in Telephony.—STEADLE.—An account of experiments made with coherers of special dimensions to protect the ear against acoustic effects of atmospheric discharges during the transmission of telephonic messages.—*Elek. Zeit.*, July 20.

Wireless Telegraphy.—An illustrated description of the wireless telegraph plant at Heysham Harbor, the Lodge-Muirhead system being used. A steamer in service to the Isle of Man is fitted with similar apparatus. The system is tuned to a wave length of 500 yards. The novel feature is that no earth connection is employed. The lower capacity surface of the antenna is insulated, consisting of a network of wires in the form of a square and covering an area of 6,400 sq. ft. Porcelain insulators are employed to support it at a height of 3 ft. from the ground. The upper aerial is of similar construction and is held in position by four masts.—Lond. *Elec.*, August 4.

BOOK REVIEW.

DIE WECHSELSTROMTECHNIK. By E. Arnold and J. L. La Cour. Berlin: Julius Springer.

The second volume of this series covers 370 pages and has 335 figures printed in the text and three plates.

In this volume the subject of transformers is handled from an engineering standpoint not from the historic, and everything out of date is avoided. The knowledge of calculus and symbolic method is presupposed. The chapters cover the following subjects: Chap. I is introductory and covers e.m.f. and winding ratios; Chap. II the curve form of the magnetizing current and the calculation of its watt and wattless components; Chap. III takes up the equations and constants of a single-phase transformer and the relations between self-induction, mutual induction and leakage; Chap. IV gives very complete graphical illustrations of vector and phase relations of pressures and currents under non-inductive as well as inductive load, and also single-phase transformer connections for three-wire circuits. Transformer losses, selection of proper magnetic circuit, the influence of frequency and most favorable distribution of losses are treated in Chap. V; Chap. VI gives the polyphase transformer built in one structure, two-phase and three-phase transformers, the monocyclic system and the single-phase-polyphase system of distribution by Ferraris-Arno; Chap. VII is devoted to choke coils, auto-transformers and the like. Chapter VIII describes the influence of e.m.f. wave form on regulation and core losses. In Chap. IX we find mechanical details of transformers of American and European construction, with reference to the cores, while insulation and windings are discussed and excellently illustrated in Chapter X. XI takes up the determination of heat radiating surfaces of transformers with or without special means for cooling. Examples of transformers of well-known makes are given in Chapter XII, with data of mechanical dimensions of cores, windings, output, voltage, efficiency, etc. In Chapter XIII the calculation of lighting and power transformers is given, while XIV contains the complete determinations and data sheets. XV relates to transformer tests and of investigation of iron, insulation, etc. XVI takes up circuit connections and connections of transformer windings for special circuits and purposes. XVII deals with transformers for measuring boosting and regulating, and Chapter XVIII refers to the polyphase system of distribution. Several tables are added containing the most essential data of designs of well-known makes. The book is very carefully prepared and is of the same high standard as other books of these well-known authors. It is especially suited for designers and instructors.

The third volume of "Die Wechselstromtechnik," by the same authors is devoted to windings for alternators and alternating-current motors. This vast subject is covered in 360 pages and is illustrated by 426 figures. This subject is carried out on somewhat similar lines as the work by the same authors for direct-current armature windings.

The production of an alternating current by means of various field pole dispositions and relations to the armature conductors forms the introductory part. By means of diagrams many different typically alternator armature windings are shown, followed by well-known direct-current types of armature windings. Following the "unaltered" direct-current windings the author shows types produced by the "cut" direct-current types of windings for the production of polyphase currents. Then he presents an interesting treatment on "altered direct-current types of windings" which permits of a greater variety of armature windings and conductor numbers for alternators, and space is also given to multiple-connected windings for collecting large alternating currents. A chapter is devoted to special windings for non-synchronous machines.

Insulation is well taken care of and many data furnished which will prove helpful to students, teachers and engineers who are not actively engaged in the manufacture of apparatus. Many detailed constructions of forms of windings are excellently illustrated. Leaving the practical side of dynamo building, the authors take up the determination of the field flux and its distribution. It is well known that the e.m.f. curve of the armature is dependent upon the flux distribution in the air-gap, the pole shoe form and windings and this subject is very carefully prepared and well worked out, also the influence of harmonics and the width of the armature slots upon the field flux variations. The rotating magnetic field is analyzed and illustrated by many simple diagrams, while the alternating-current field is considered as a resultant of two fields rotating in opposite direction with the same angular velocity, a method first mentioned by Prof. Ferraris. In Chapter XI the authors determine the field curve, a curve which represents the air-gap flux density as a function of the armature circumference. It is used for determining the armature e.m.f. curve. At the end of the book they give an exact method for its determination, which although highly interesting will hardly be used by designers because the much simpler method described above answers, it is believed, all practical purposes.

On page 32 the authors refer to the Heyland motor, and one would expect in a book on motor and generator windings to find a proper account of this now well-known design, but in this respect the otherwise excellent volume is lacking.

The fourth volume of the series is entitled "Die synchronen Wechselstrommaschinen," by E. Arnold and J. L. La Cour. It is a work covering 840 pages, with 314 figures printed in the text, and 13 plates. In their introductory remarks the authors state that for the purpose of obtaining reliable results it has been frequently necessary to use an amount of mathematics which may prove to be beyond that at the command of the practical engineer, and he is not expected to look upon this book as a textbook, but rather as a reference book to which he would turn to consult those branches in which he is particularly interested. As the mathematical requirements made on the engineer increase yearly, the progressive one becomes a good student and it is the duty of the technical schools to see that the graduates have a good mathematical foundation so students will not have much trouble in mastering the subject. They call special attention to certain parts of the book treating on the design and predetermination of alternating-current generators and refer to the change of potential at the generator terminals due to load variations and further to the heating under load. The closer these quantities can be predetermined the better is the designer enabled to use economically the material without passing the limits mentioned in the specification. For the purpose of determining the voltage variation, the knowledge of the armature reaction and that of the reactance of the armature winding is essential. The armature reaction is very minutely described and determined by graphical and analytical methods. It is resolved into the cross magnetizing action of the watt current and the demagnetizing action of the wattless current and can be determined accurately from the no-load characteristic. For the determination of the reactance some formulæ are given which are sufficiently accurate for practical purposes. The authors use the title "synchronous alternating-current machines" in a broader meaning than is customary; they designate by this name all types of dynamos, motors or rotaries whose field excitation is produced by direct current. The design of machines is investigated and calculated in all their details and illustrated by examples. Considerable space is devoted to the hunting action and parallel working of alternators, further self-exciting machines and methods of compounding such as developed by Hutin and Leblanc, Heyland and Boucherot are discussed and analyzed.

The rotary transformer forms the last part of this excellent work. It is analyzed in all its phases of construction, operation and tests in twelve chapters. Twelve plates give sectional views of representative alternators, while plate 13 shows magnetization curves per centimeter length of magnetic circuit for different values of B for various irons.

This work shows throughout the care and painstaking characteristic of these authors, not only in the treatment of the subject, but also in the neatness of its publication. This as well as the earlier volumes will be a valuable addition to any engineer's or scientific library. As a reference book it will be a standard, but its value may still be enhanced by furnishing besides the permanent key of reference letters a detached one for obvious reasons.

Recent Improvements in Switchboard Details.

By E. P. Edwards.

Recent years have shown a rapid and wonderful advancement in the science of electricity. This forward movement has been so marked and so universal in its nature that no one of its ramifications stands out in bold relief as an example of radical improvement. Present practice constitutes a series of revolutions when compared with the methods and achievements of from five to ten years ago. One of the most absorbing problems that presents itself to the engineer to-day, is the development of suitable apparatus and appliances for properly controlling and measuring the electrical forces at his command.

Switchboard engineering is a branch of electricity which has made great strides in recent years. A few years ago the switchboard was given grudging consideration, but it is no exaggeration to state that, at the present time the design of a switchboard in all its details receives as careful attention as the apparatus which it is to control, and the specifications under which it is built are as rigid as those governing the construction of this apparatus.

While the necessity will always exist for special switchboards and switchboard devices, the last few years have shown a marked tendency toward standardization. This is a natural condition, and its benefits are manifest. Uniformity, better workmanship and better deliveries are insured. Prices are reduced as a necessary consequence of the concentration of energy and the saving effected through decreased charge for development, drafting and engineering.

The illustrations used in this article will give a fair, if somewhat meagre, idea of the mechanical perfection that has been reached in switchboard construction as carried on by one of the prominent manufacturers of this country. Because of space limitation it is impossible to cover in detail all of the devices shown, but sufficient importance attaches to the subject of automatic protection to warrant special attention.

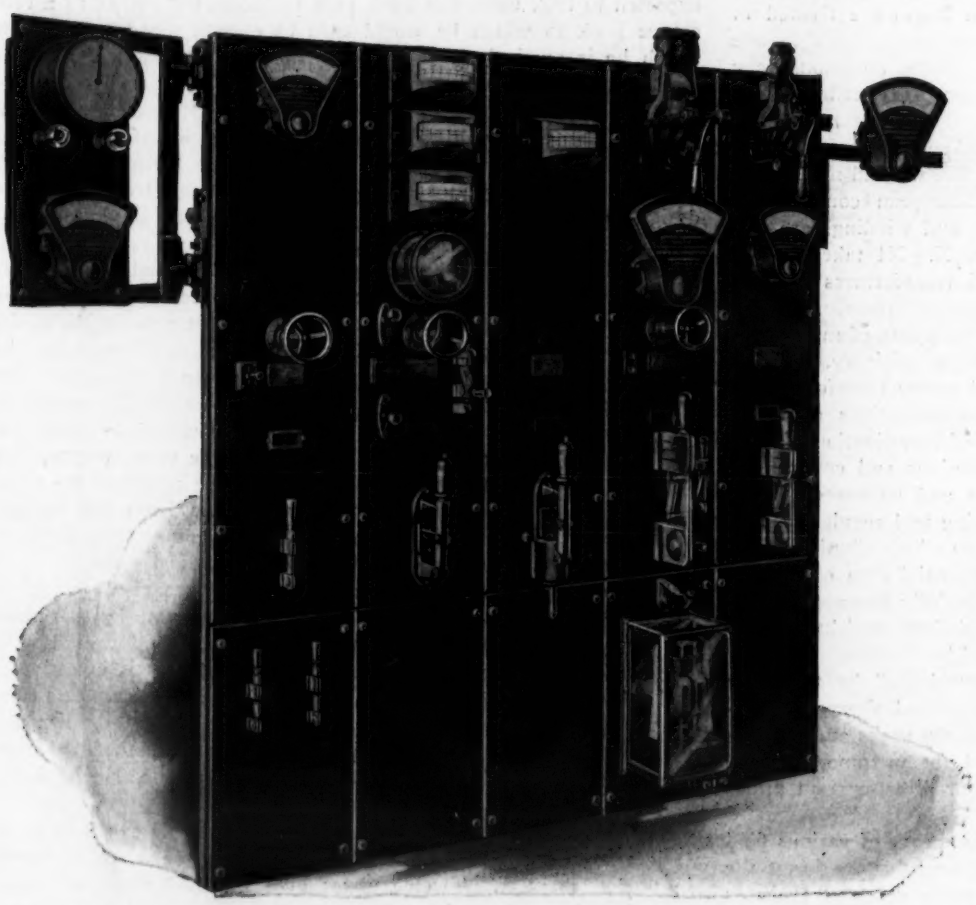


FIG. 1.—COMBINATION DIRECT AND ALTERNATING-CURRENT RAILWAY SWITCHBOARD.

FIG. 2.—MOTOR-OPERATED BREAKER, 11,000 AMP.

Safety is the watchword of the station operator of to-day and the automatic circuit-breaker is his main reliance. Ammeters, wattmeters, voltmeters, power factor indicators, automatic regulators, synchronism indicators and other measuring and regulating devices are essential, but the automatic switch or circuit-breaker is pre-eminently THE essential. Upon its reliable operation and ability repeatedly and successfully to perform its functions under the most severe conditions, often depends the safety of thousands of dollars worth of apparatus, and its use affords the best insurance against those interruptions in service that might entail great pecuniary loss to the operator.

Broadly speaking, automatic protective devices may be divided into two classes, those for use on direct-current systems, and those for use on alternating-current systems. The air-break circuit-breaker is typical of the former class, the oil switch of the latter.

The purpose of this article is to deal briefly with the carbon-break circuit-breaker. The automatic circuit-breaker, as it stands to-day, embodies the results obtained from years of experience and constant experiment.

The prime object of a circuit-breaker was automatically to protect a system against the evil effects of short-circuits and overloads; now automatic protection can be secured for almost every service condition arising. Circuit-breakers can be made to operate from a distance, by means of motors, solenoids or float mechanisms, tripping automatically on overload, underload, low voltage, high voltage, reversal of current, or phase reversal. The overload circuit-breaker is of dominant importance.

A general survey of the essentials in circuit-breaker construction reveals the following characteristics:

1. The breaker must be capable of opening the circuit under the most severe conditions of short circuit, as upon its reliability in this respect depends the safety of all of the apparatus which it is designed to protect.

2. It should be mechanically simple and compact; it should be durable, and the use of springs and delicate parts that will not withstand continued rough usage should be avoided.

3. All parts should be readily accessible and capable of easy renewal.

4. Perfect contact surface should be secured, and moderate temperature rises under normal load conditions should be insisted upon. This temperature rise should not exceed that guaranteed for the apparatus with which the breaker is to be used. Commercially, this is all that can be reasonably expected. Effectiveness as a protective device is so much more essential than efficiency expressed in terms

of energy lost, that the latter consideration is of subordinate importance.

5. The circuit-breaker should be easy to close, so that it may be mounted above the other appliances on the switchboard, removing them from the danger zone of the flaring arc that is a necessary evil of air-break device.

6. Knife-blade construction should be avoided, the contact secured being inferior to that obtained by using the laminated brush, and any "bugging" of the clips or blades produces a tendency to stick, which may result fatally to the apparatus of the system.

facture of circuit-breakers, and the accompanying cuts will give some idea of the great progress that has been made in recent years.

An important installation has just been made by the Edison Illuminating Company of New York. This consists of nineteen 3,000-ampere, thirty-two 6,000-ampere and four 11,000-ampere, 250-volt circuit-breakers; four of the 6,000-ampere, and the 11,000-ampere breakers, are motor operated, remote controlled, the others being hand operated.

Fig. 2 shows one of the 11,0000-amp., motor-operated breakers,

FIG. 3.—CIRCUIT-BREAKER WITH LOW-VOLTAGE RELEASE, 500-AMP., 250- VOLTS.

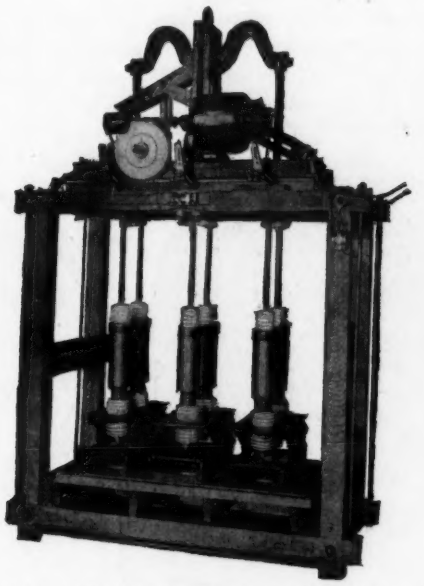


FIG. 4.—MOTOR-OPERATED OIL SWITCH, 13,000 VOLTS.

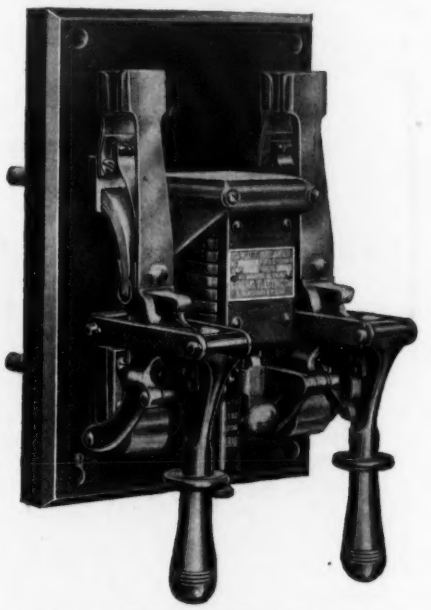


FIG. 5.—OVERLOAD CIRCUIT-BREAKER, 300-AMP., 250-VOLTS.

7. The main contact brush should be adequately protected by carbon and copper auxiliary contacts through which the current is shunted by the opening of the main contacts and on which the final break should occur.

These contacts are of vital importance to the life of the circuit-breaker. This is especially true of the carbon secondary contacts,

FIG. 6.—OVERLOAD CIRCUIT-BREAKER, 6,000-AMP., 650-VOLT.

no matter how roughly the breaker is handled. A broken carbon which should be so constructed that they cannot possibly be broken, will often result in the total destruction of the circuit-breaker, with a suspension of service as a consequence.

A high standard of excellence has been arrived at in the manufacture of circuit-breakers, and the accompanying cuts will give some idea of the great progress that has been made in recent years.

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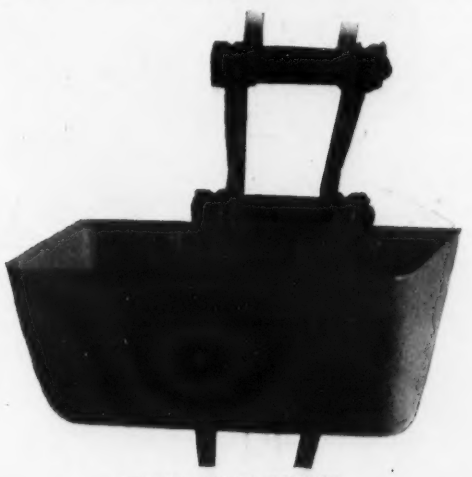
Fig. 2 shows one of the 11,0000-amp., motor-operated breakers, which is the largest ever built. The breakers illustrated in this article represent the designs of the General Electric Company.

Pressed Steel Buckets.

The Link-Belt Engineering Company, of Philadelphia, is using pressed steel in the manufacture of elevator buckets. The new buckets, made in one piece free from seams and rough surfaces, are from 20 to 40 per cent. lighter than malleable iron buckets of corresponding sizes. The accompanying illustration shows the uniformity of gauge and the symmetrical design. The superiority of the new pressed steel buckets over cast buckets is obvious. Compact and light, they obviate the destructive wear on chain and sprocket wheels and prolong the life of the elevator, a factor of importance to the users of this class of machinery. Where cement, sand, grain,



PRESSED STEEL BUCKET.

coal, gravel and materials of a like nature are to be handled, the use of these buckets should prove advantageous. Users of japanned or galvanized buckets recognize the superior qualities of pressed steel in the service demanded by the conditions that exact special surfaces in conveying buckets.

"Commercial" Induction Motors.

The Commercial Electric Company, Indianapolis, Ind., is placing on the market a line of induction motors, in the design of which the services were retained of Mr. H. M. Hobart, of London, the well-known authority on induction motor design. The details of this motor are illustrated in Fig. 1 and the complete motor is shown in Fig. 2.

It is well known that in order to produce a high power factor in induction motors it is essential that there shall be a limited clearance between the rotor and stator. In the present motor the design of the stator frame and stator head is such that an equal division of this clearance is always secured and maintained, it being an impossibility to assemble the machine in such a manner as to give the rotor an unequal air-gap on opposite sides. In order to reduce the wear of the rotor shaft to a minimum, very large bearing surfaces have been provided. The bearings are also so designed that if the operator should flood them with oil no damage to the machine could possibly occur. The bearing linings are duplicate and interchangeable; thus, it is claimed, making the replacement of the bearing a much more simple and less expensive matter than is involved in the accurate re-adjustment of "adjustable" bearings. The shaft is accurately ground to gauge, the bearings are polished and the rotors are mounted on the shaft by means of hydraulic pressure. Ventilating apertures are provided across the faces of the stator and rotor cores, thereby causing a free circulation of air and insuring cool operation.

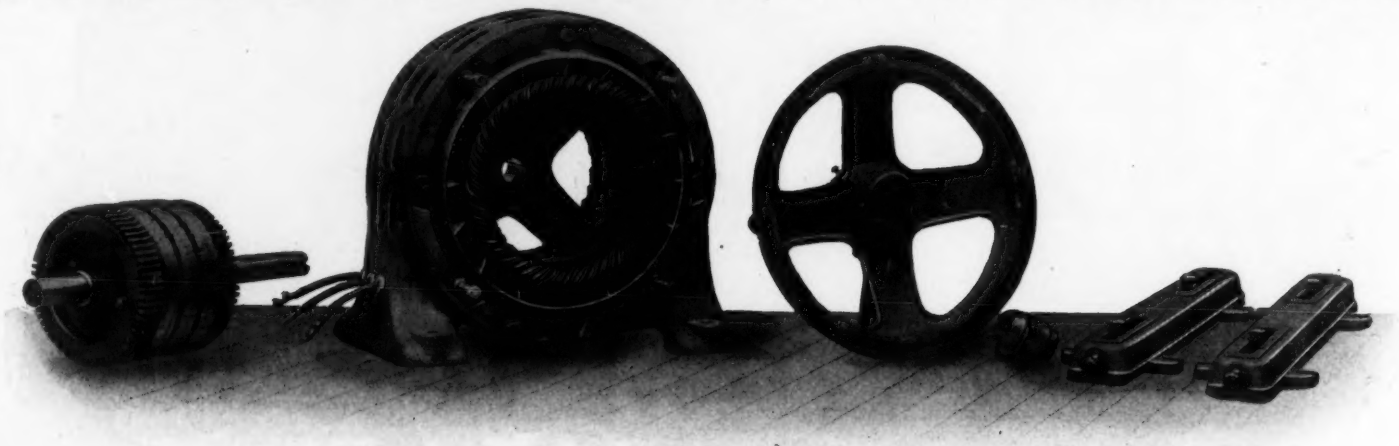


FIG. 1.—DETAILS OF MOTOR.

FIG. 2.—MOTOR.

The motors are manufactured in all standard ratings from 5 hp to 200 hp. A line of small single-phase, self-starting induction motors is also made in ratings from 1 hp to 5 hp. The machines are made for all standard voltages for both two and three-phase circuits and for frequencies of from 25 to 60 cycles.

The Subways in Chicago.

In connection with the proposal of the city of Chicago to install and operate its own telephone service, the right of the municipality to the free use of the subways of the Illinois Tunnel Company was asserted last week by city officials and a notice was served on the company that city employees may at any time begin to place wires in the conduits for the service of the telegraph, telephone, electric light and signal service of the city.

The move looking to a reservation of the alleged rights of the city was made by Comptroller Lawrence McGann in a letter sent by him to City Electrician Carroll. Another letter was also sent to the chief of police calling attention to the alleged right of city employees to free access to the tunnels and asking that a proper inspection be made to secure the safety of persons working in the conduits.

The letter to the city electrician was followed by a reply in which it was declared that the lowering or destruction of the traction tunnels would be the first occasion on which the city would need the Illinois company tunnels for wires.

City Electrician Carroll says: "We shall want to place approximately four cables two inches in diameter from the north side of the river via Wells Street to Washington Street, Washington Street to La Salle Street and La Salle Street to the City Hall. Also about the same number of cables from Van Buren and Clinton streets, via Van Buren to Fifth Avenue, Fifth Avenue to Washington, Washington to La Salle, and La Salle Street to the City Hall. These cables can be attached to the roof of the tunnel, in the same manner as the Illinois Telegraph & Telephone Company's cables are attached at the present time. We should be afforded the same facilities for getting in and out of the tunnel as are afforded to the telephone company, and our men should have the use of a car wherever they have tracks for their own use in placing and whenever necessary for repairs on these cables. In addition, we will probably want to use the tunnels for other telegraph, telephone and electric lighting service wherever they have tunnels. The number and size of cables required being from one cable one inch in diameter to four cables two inches in diameter."

Electrical Sales in the Far East.

The activity in electrical lines in the Far East is indicated by recent orders received by the General Electric Company through its foreign department, for electrical apparatus for use in eastern countries. Mitsui & Co., Tokio, Japan, have purchased one three-phase, revolving-field, 200-kw, 60-cycle, 2,300-volt generator and one 110-volt, 7-kw, direct-current marine generating set with switchboard. Another order for the Kosaka Copper Mines, Japan, consists of one motor-generator comprising a 100-hp, 3,120-volt induction motor, direct-connected to a 75-kw, 550-volt, direct-current generator. In addition to the above for Japan, a recent order includes 28 miles of single-conductor, lead-covered wires of various sizes, and 22 miles of stranded lead-covered cables of various sizes.

Australian orders include six General Electric 58 double-motor railway equipments for the Perth Electric tramways, and one 10-kw, one 16-kw and one 25-kw storage battery booster set for the New Zealand Electric Construction Company.

The Siam Electricity Company, Bangkok, Siam, has purchased a 500-kw, 550-volt, direct-current, two-stage Curtis steam turbine alternator, several direct-current pump motors and a switchboard.

South African orders include two 500-kw, three-phase, 2,300-volt Curtis steam turbine alternator sets and one 450-hp, 2,080-volt, two-speed induction motor for Robinson Deep Mine, one 1,000-kw, 3,300-volt, three-phase Curtis turbo-alternator set and sixteen 200-volt induction motors aggregating 115 hp for the Consolidated Gold Fields of South Africa, Limited.

In addition to the above for the Far East, Brazilian orders come from South America as follows: Five two-motor General Electric 58 equipments with controllers and electric brake for Jardin Botanico, Rio de Janeiro; eleven 440-volt induction motors aggregating 220 hp; forty type H transformers aggregating 400 kw, with switchboard equipment for Mococa, Brazil. The Rio de Janeiro Tramway, Light & Power Company, Brazil, has purchased a 200-kw, 50-cycle testing transformer with 150,000 as maximum, stepping up from 216 volts primary, and there have been ordered for Manaos, Brazil, two 150-hp, 550-volt, direct-current motors and one 400-kw, 575-volt, direct-current generator for direct connection to a Harrisburg engine.

A New Type of Revolving-Field Alternator.

The accompanying illustrations show an alternator, the construction of the field magnets of which departs materially from that of the older type of revolving-field machine. Referring to Fig. 1, it will be noted that the field coils (of which there are only two, regardless of the number of poles) are wound concentric with the shaft in the line of mechanical motion, and therefore the mechanical placing of the coils is facilitated. The air-gap between polar faces and armature iron may be as short as mechanical clearance may require, and not excessive as in older types. The decrease of the air-gap allows a corresponding decrease in the exciting current, while the peculiar construction of the field cores allows the use of a heavier current density in the field winding without a corresponding increase in temperature.

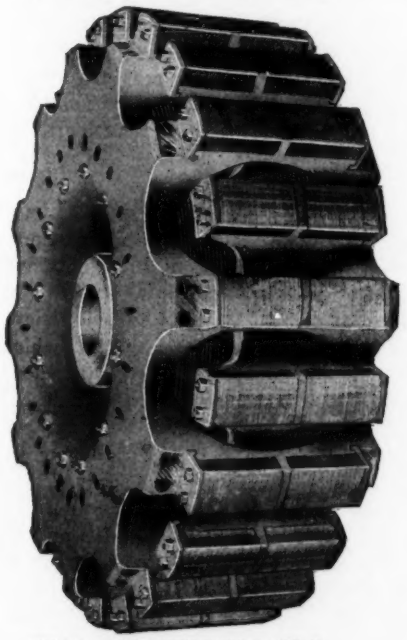


FIG. 1.—NEW REVOLVING FIELD.

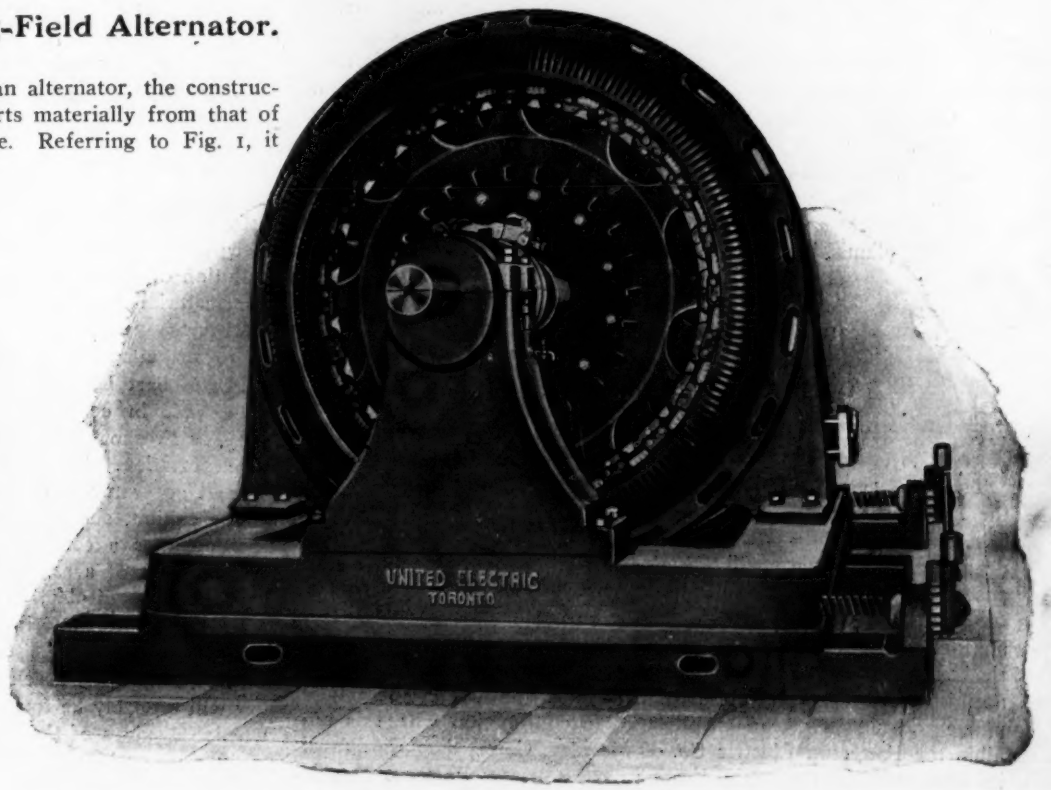


FIG. 2.—END VIEW OF ALTERNATOR.

By using this same construction, but with the addition of a short-circuited bar winding on the field cores for self-starting, these machines may be used as motors. The generators or motors are interchangeable; that is, the machine may be used as a commercial synchronous motor or generator at pleasure under the most favorable conditions.

Fig. 2 gives an end view of the completed machine, and shows also the short-circuited winding. When the machine is to be operated as a motor, it can be thrown directly on the line as an induction motor. When the rotor is up to speed the field can be excited and the machine will thereafter operate as a synchronous motor. This auxiliary winding is of use also where two or more generators run by separate engines are to be operated in parallel on account of the fact that it assists in keeping the machines in exact synchronism. It is stated that when used as a generator the regulation is practically the equivalent of what is found in static transformers.

These machines are manufactured by the United Electric Company, of Toronto, Canada, according to the designs of the inventor, Mr. W. A. Johnson, of that place.

Exhaust Steam for Station Auxiliaries.

An abstract was published recently in these pages from the National Electric Light Association "Question Box" of the answers as to central station exhaust, etc. Mr. R. H. Ramsey, of the Harrison Safety Boiler Works, Philadelphia, writes us as follows on the subject:

"We are very much interested in the article entitled 'Feed Water, Heaters and Pumps' in your issue of July 22. We quote from this article as follows: 'To the query "Is it good practice to turn exhaust from station auxiliaries into an open type feed-water heater?" the twelve replies would indicate that an open type heater accumulates the oil, thus making poor water to feed to the boilers, and, therefore, if the practice is followed an oil separator should be used.' As a matter of fact, if a Cochrane feed-water heater is used there is no danger from oil, for every Cochrane heater is equipped with a Cochrane oil separator.

"Cochrane oil separators are now protecting more than 4,000,000 horse power of boilers from oil. They are mechanical appliances, and, therefore, if they ever give good separation under normal conditions (they have done it thousands of times), they will repeat the results wherever the conditions are repeated. Do you not think that this matter is of sufficient importance to your readers from an engineering standpoint to point out editorially the facts as they exist? The only advantage claimed for the closed heater, according to the synopsis given in the article quoted, is that it keeps the oil out of the boilers, while, on the other hand, a number of important advantages for the open heater are stated (though these advantages do not represent nearly all that the open heater possesses). Eliminating the commercial side of the question, would it not be of interest to your readers for you to tell them that they can obtain all of these important advantages without having to fear oil, if they will install the right kind of an open heater?

"Again we quote from this article as follows: 'In regard to the method of driving auxiliaries, a correspondent states that "in a non-

condensing plant a motor-driven pump is doubtless the most economical form that can be employed. .. .' In turbine plants steam-driven auxiliaries will be more economical up to a point where all of the exhaust steam can be condensed in heating the feed water.' In a non-condensing plant less than 10 per cent of the heat in the steam is utilized in the engine, the remaining 90 per cent or more being wasted unless the exhaust steam is utilized. In the plant in which everything is run condensing, less than 15 per cent of the heat in the steam is utilized in the engine, and the remaining 85 per cent or more must be dissipated by the condensing water and wasted in order to obtain the 15 per cent efficiency. But in a plant in which steam-driven, non-condensing auxiliaries are used and the exhaust steam is utilized in a Cochrane open heater, these auxiliaries ordinarily will have an efficiency of practically 100 per cent, for all of the heat in the steam not utilized in doing work (and the quantity of heat utilized is the same as in the case of the motor-driven auxiliaries) will be conserved and turned back into the boilers. This proposition is true of a condensing plant, whether turbines or reciprocating engines are employed. Since no motor-driven or condensing auxiliary can give an efficiency of anything like 100 per cent, does not the independent steam-driven, non-condensing auxiliary, when used with an open heater, represent far better engineering practice than motor-driven auxiliaries?

"Aside from the question of economy of operation, there is also the important question of first cost, insurance and depreciation, and here the non-condensing auxiliaries and an open heater easily have the advantage.

"If this doctrine is true (and it can be demonstrated both theoretically and in actual practice), do you not think that technical editors should insistently preach it to the owners, designers and operators of condensing plants?"

More Exhibits at the Portland Exposition.

Last week a number of electrical exhibits at the Portland Exposition were described in these columns. A few further notes are now given as to other exhibitors:

The Holtzer Cabot Electric Co., of Brookline, Mass., exhibits in the Agricultural Building a 500-volt, direct-current motor in operation, belted to a coffee-cleaning and roasting plant, giving a practical demonstration of the application of its motors for commercial purposes. The company also displays a watchman's clock or time detector, suspended on the north wall of its booth, having several test stations connected to and surrounding it to demonstrate its practicability. Here are also shown a long distance telephone, both 4 and 5-bar telephone generators, and the Ness automatic house telephone and single station telephones. In conjunction with this exhibit, the Patterson Electric Co. of Meriden, Conn., displays one of its electric clocks essentially consisting of a master clock working in conjunction with a secondary clock and operating a set of Westminster chimes, hung over the entrance to the boot, and striking the quarters and hours. There is also exhibited in this connection a keyboard electrically connected to 13 bells or chimes arranged in symphony so as to permit the playing of ordinary airs thereon.

The John A. Roebling Sons' Co. of Trenton, N. J., has an exhibit space of some 300 sq. ft. in area, in which it gives a complete demonstration of the many and varied adaptabilities of its wire rope and cables. In the center of the display space is shown a glass cabinet containing on a revolving pyramidal form, neatly and systematically arranged, a variety of wire and wire rope for nearly every purpose, comprising telephone, power transmission lines, etc. Prominently displayed, apart from the pyramid and directly back of one of the glass sides of the cabinet, is a small spool wound with wire 1-1000 of an inch in diameter and drawn from a steel bar 4 in. square, making a truly unique adjunct to the exhibit, as well as demonstrating the capabilities of the company's factory to manufacture wire of any requisite size for practically any purpose. The other side of the pyramid, already mentioned, are samples of heavier grades of wire rope and cables. The display to the left contains two sections of cables, in actual use for years and built for the Brooklyn and Williamsburg bridges, the diameters of which are 15½ and 18½ in. respectively, while a third section of cable, considerably larger, is also shown of 21¾ in. diameter, being a sample of cable now under construction for the new Manhattan bridge, New York. The other section is devoted to various types and sizes of transmission sheaves, arranged on display boards, as well as numerous tools, fittings and appurtenances in general use, in the manufacture and laying of cables. Among these may be mentioned hooks, clips, alligator and drop forged wrenches, etc., etc., and below them are shown samples of the fittings in application. Three large photographs are suspended above the display, the center one showing the factories of the company at Trenton, N. J., while on either side are the Brooklyn and Williamsburg bridges, respectively. The exhibit is attractively decorated and illuminated with numerous incandescent lights and electric display signs, and is in charge of one of the company's Western representatives.

The B. R. Electric & Telephone Company, of Kansas City, have erected a booth in the Machinery, Electricity and Transportation Building, in which they exhibit a comprehensive and varied display of telephone machinery and apparatus. Immediately opposite, and facing one of the main aisles of the building, are two telephone switchboards of 100 and 50 lines capacity, respectively, so arranged as to display the complete mechanism; also near by is a Warner "pole changer" on a stand opposite which is a dry cell battery of extraordinarily large dimensions. The battery is 27 in. in height, weighs 125 lbs. with a capacity of 1-15 volts and 92 amperes and naturally attracts a good deal of attention, proving to be quite a unique feature of the display. The interior of the booth contains a collection of telephone apparatus. A showcase containing linemen's test sets, and portions of central energy equipment, etc., occupies one side of the display space, while Moon terminals and terminal heads, as well as Stombaugh anchors of different types and sizes are seen on the opposite side of the aisle. The display of central energy telephones, mining telephones, rural switchboards, plug boards, the latter adapted for small country exchanges, is very complete in every particular; two small display boards showing respectively the evolution of the telephone generator and ringer movement from the raw material necessary for its construction to the finished article; rural telephones, linemen's tools neatly arranged in consecutive order, go to make up an exhibit both interesting and instructive.

The Hobart Electric Manufacturing Company, of Troy, O., have an exhibit in conjunction with the Storer Manufacturing Company, of Freeport, Ill., in the Building of Machinery, Electricity and Transportation. The display comprises a 115-volt, 27-kw, direct-current generator in operation, used to illuminate the display signs of the exhibit, and belted to a Stover 10-hp gasoline engine, which also operates a centrifugal pump, pumping 63,000 gals. per hour into and out of a series of wooden tanks placed near the side entrance to the display, illustrating the capabilities of the pump.

By those interested in transportation and transportation machinery generally the exhibit of the Baldwin Locomotive Works, Philadelphia, Pa., in the Machinery, Electricity and Transportation Building will probably be found to be one of the most distinctive and attractive displays of that nature in the hall. Suggestively facing the steam locomotives is a Baldwin-Westinghouse 70-hp electric locomotive and weighing 20,000 lbs., designed for industrial plants and contractors' use and fitted with 250-volt, direct-current Westinghouse motors. This machine is small, compact and withal, powerful. In another section of the exhibit is displayed the Baldwin Company's interurban railway truck identical with those at present used by the Twin City Rapid Transit Company, of Minnesota. The truck is made entirely of wrought iron and steel and is put together with the same care and workmanship that distinguishes their locomotives. The company manufacture several sizes of railway trucks ranging from 5,300 lbs., weight suitable for street railway service, to 12,500 lbs. for interurban service.

The exhibit of the Standard Paint Company, of New York City, in the Manufacturers' Building was a typical display of its Ruberoid roofing material, insulated tape, Ruberoid flooring preservative paints, etc. A very practical demonstration of the roofing material as used commercially is shown by two models, representing a saw mill and a lumber or shingle dry kiln respectively, each being very ingeniously put together architecturally, and roofed with two-ply Ruberoid. The models are placed on each side of the booth, the center being utilized to display Flexite preservative paints arranged in a pyramidal form toward the front of the exhibit, the space to the rear being occupied by S. P. C. and P. & B. insulated tape, building papers and roofing material in packages or rolls of commercial sizes. The whole display is tastefully decorated and reflects credit on the designer, the models particularly attracting the visitor's attention

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Satisfactory net results are reported for the week's business, the uniformly favorable reports of late having been affected by some adverse factors of a temporary nature. Numerous strikes have occurred, exerting the customary pernicious influence over business, and the epidemic of yellow fever is restricting Southern trade. On the other hand, the hot weather has facilitated retail trade, crop prospects have greatly improved, and out-of-town buyers are numerous in all the leading markets. Preparations for winter and spring distribution of merchandise are no longer handicapped by uncertainty regarding agriculture, for harvest operations are progressing rapidly under better than average conditions, and there is little anxiety regarding the future. Manufacturing plants are increasingly active, textile mills still occupying the strongest position, while shoe shops are not making concessions to get business. Iron furnaces and steel mills make progress, but less rapidly. Iron is rather quieter in demand, the reflection probably of the late advance restricting sales. Output in July was reduced and stocks unsold increased slightly. Finished products are in active request and the mills are pushed to meet orders. Structural material and rails are in good request for this season of the year. Plates are selling better on the Atlantic coast. Steel billets are in active request and very firm. Bituminous coal is rather quiet and easy in price. Lumber mills and dealers are having an exceptionally busy season. Railway earnings in July were 7.4 per cent greater than in the same month last year, and foreign commerce at the port of New York for the week showed an increase of $3,917,439 in imports, while exports decreased $1,969,227. The copper market advanced during the week, electrolytic being in good demand. Dealers demanded 15¾ for delivery during the next eight weeks. Lake is quoted at 15⅝, and casting stock at 15¼. *Bradstreet's* reports 166 business failures during the week ending Aug. 10, as compared with 178 the week previous and 167 in the corresponding week last year.

GROWTH OF EXPORTS.—Exports of manufactures from the United States in the fiscal year 1905 were not only the largest on record, but are in excess of the combined ?xports of all articles in the centennial year, 1876, and nearly $140,000,000 more than the total imports and exports of the country at the close of the Civil War. Statistics just compiled by the Bureau of Statistics of the Department of Commerce and Labor show that the exports of manufactures in the year just ended amounted to $543,620,297, as against $452,415,921 in the preceding year, $433,851,756 in 1900 and $183,595,743 in 1895. The growth in exports of manufactures far exceeds the growth of population or the growth in commerce as a whole. This is apparent from an examination of the following table showing the population, commerce and exports of manufactures of the United States in 1800, 1875 and 1905, and the percentage of increase in each since 1800 and 1875, the beginning of the greatest era in American development:

Year.	Population.	Commerce (imports and exports of mechandise).	Exports of domestic manufactures.
1800	5,308,483	$162,224,548	$2,493,755
1876	45,137,000	1,001,125,861	100,492,055
1905	83,145,000	2,636,074,349	543,620,297
Per cent of increase:			
1800-1876	750	517	3,930
1876-1905	84	63	441

An examination of the statistics of exports of domestic manufactures, especially in recent years, by articles and countries of destination, shows that about thirty manufactured articles were exported during 1905 with value in excess of $1,000,000 each, and that of these articles all except seven showed an increase as compared with exports of 1904.

ELECTRICITY IN MEXICO.—Recent sales through the foreign department of the General Electric Company indicate that electricity is well established in every day use in Mexico. The Pueblo Compania de Luz y Potencia has purchased two 220-volt induction motors, 50 and 35 horse-power, and four transformers of various capacities, for use on 2,300 volt transmission lines stepping down to 220 volts for distribution. The city of Tepic will use two revolving field three-phase 350 kw 6,600 volt generators and two 22 kw 25 volt exciters, together with generator and substation switchboards and small transformers aggregating 650 kw. The Mexican Light & Power Company has ordered one feeder panel and one mercury arc rectifier panel for its El Oro substation. The Guanajuato Power & Electric Company has purchased a horizontal revolving field three-phase 3,000 kw 2,300 volt alternator for direct connection to water wheel, and four water cooled 60-cycle, 1,080 kw transformers stepping up to 60,000 volts for line transmission, and four 60-cycle water cooled 970 kw transformers stepping down to 15,700 volts, from the line potential supplied by the first four transformers. In the same city the Guanajuato Reduction & Mining Company has ordered eight induction motors of various sizes aggregating 375 horse-power for use on 440 volt circuits.

A CHEERFUL OUTLOOK.—Interests identified with the Standard Oil Co. in one way or another are extremely bullish, says the *Wall Street Journal*, on general business conditions. Through its many agencies the Standard Oil Co. is in touch with business developments throughout the country at all times. The reports it has received over the last few weeks are such as to warrant the optimistic stand taken by John D. Rockefeller and his associates. A person in close touch with the Standard Oil Co. said: "Business prosperity is in evidence everywhere. It is of a genuine character, and if half the people of the United States turned pessimistic, a continuation of the prosperous business conditions that now prevail could not be checked. If any person fails to make money this and next year he cannot say the country has not done its duty. We will have no money scare this year. Rates may get a little high at times, but the average quotations for call and time money will be reasonable."

THE PELTON WATER WHEEL COMPANY reports new orders, as follows: From the Homestake Mining Company, Lead, South Dakota, an 800-hp Pelton wheel direct-connected to an electric generator. The Homestake mines comprise probably the largest and most permanent low grade deposits in the United States and their operations are of great magnitude. From the Nevada Power Mining & Milling Company, an order for an additional Pelton of 3,000 hp maximum capacity, direct-connected to an electric generator and operating under a head of 990 ft. This company is now installing two Pelton wheels for direct connection to 750-kw generators and proposes to transmit power to Tonopah and Goldfield, Nev. Through Mitsui & Co., San Francisco, an order was received for a 500-hp wheel for use in an electric light station in Japan.

RAILWAY ELECTRIC POWER CO.—The Ganz system has been taken up for this country by the Railway Electric Power Co., as already noted in these pages. The company has just issued a handsome pamphlet, descriptive of its three-phase Ganz apparatus and methods, particularly as applied to the Valtellina road, of which a full account we gave lately. The company hopes to benefit by the general awakening of interest among the large steam railroads in electric traction. The headquarters of the company are at 114 Liberty Street, New York, and the officers are Stephen Peabody, president; Leopold Wallach, vice-president; Gustave Leve, second vice-president; John E. Borne, treasurer; D. W. Kincaid, assistant treasurer, and Henry L. Sprague, secretary.

LONDON COUNTY COUNCIL CONTRACT.—Five tenders were submitted to the London County Council for the reconstruction, electrically, of the tramways from North Street, Wandsworth, to Westminster Bridge, via York Road, Battersea Road, etc. The bid of J. G. White & Co. has been accepted at £163,874, or about £1,600 less than the engineer's estimate. The successful bidders are allowed to sublet part of the work to the Lorain Steel Company.

BROOKLYN FIRE ALARMS UNDERGROUND.—Bids will be received until August 21 by Thos. W. Churchill, deputy and acting fire commissioner, New York City, for furnishing material and placing conduits for the fire department, telegraph and alarm system underground in the Borough of Brooklyn, and for alterations and additions to the fire alarm telegraph system in the Borough of Richmond.

THE STROMBERG-CARLSON TELEPHONE MAUFACTURING COMPANY, Rochester, N. Y., reports having closed contracts for switchboards for the following places: Kansas City, Mo.; Decatur, Ala.; Boise, Idaho; Creighton, Neb.; Unadilla, N. Y.; Maquoketa, Ohio; Granite Falls, Minn.; Charity, Mo.; Greenville, Ohio, and Crystal, N. D.

ELECTRICITY ON LACKAWANNA.—The recent destruction by fire of the Delaware, Lackawanna & Western Railroad depot at Hoboken, may hasten the adoption of electric traction on part of that system. The plans for the new depot include a large power equipment, but this would hardly take care of all the traction requirements if electricity were to be adopted on a large scale.

ELECTRICITY ON THE CENTRAL.—The New York Central & Hudson River Railroad has placed orders with the General Electric Company for the complete electrical equipment for the cars to be used in its suburban service. These cars are in general similar to those now in use on the Interborough Railway in New York City. One hundred and twenty-five complete car equipments have been ordered. The Sprague-General Electric multiple-unit train control system will be used and each car will be equipped with two General Electric 69 200-hp motors. The equipment is so designed that trains consisting of ten motor cars may be operated, although, of course, the motor cars may be operated singly or in groups of less than ten if desired. It is expected that cars of this type will eventually take care of all the suburban service on the electric zone of the New York Central. The order for electric locomotives has recently been increased to thirty-five. These are also made by the General Electric Company and are exact duplicates of the one which has been running for some months on the experimental tracks of the New York Central and which has been fully described in these columns. The locomotives will haul the through trains between Croton, 35 miles from New York, White Plains, on the Harlem division, 25 miles out, and the New York Central station, and eventually no steam power will be used in hauling trains out of the New York Central station. The suburban cars are of steel, and the total order of 175, it is reported, has been placed with the American Car & Foundry Company.

BIDS WANTED.—Sealed bids will be received by John Holton, chairman electric light committee, Stoughton, Wis., until Aug. 26, for the following electrical apparatus and power equipment. The work will be let as follows: Power house; one 150-hp water tube boiler, one 150-hp steam turbine and generator, one 100-kw generator and two exciters, two switchboards, arc light transformers, 50 arc lamps, one water wheel governor for two 100-hp wheels, one condenser, feed-water heater and pump. An old arc machine and switchboard will be for sale. Plans and specifications may be seen at 1636 Monadnock Blk., Chicago, and blank proposals obtained at 31 Vroman Bldg., Madison, Wis.

Financial Intelligence.

THE WEEK IN WALL STREET.—The sentiment in stock trading was decidedly bullish owing to the more satisfactory reports and the more favorable outlook as to the peace negotiations at Portsmouth. Railroad and industrial stocks generally showed advancing tendencies, but the features, as recently, have been extreme advances and new high-price records in various gilt-edged dividend-paying railroads. Easy money market conditions are also an influence, there being little apprehension of high interest rates during the crop-moving period. Continued favorable news about steel-trade conditions and prospects resulted in keeping up the quotations for the United States Steel stocks and the 5 per cent bonds of that corporation. The greatest gain in electric stocks was in General Electric, which closed with a net advance of 6 points, the last quotation being 184. Westinghouse made a net gain of 2½ points, closing at 170½. Both the Allis-Chalmers issues are down, the common closing at 17, which is a loss of 1¼ points, and preferred at 59, a net loss of 3 points. Western Union made a gain of ¼-point, closing at 93¾. Electric Storage Battery receded 1½ points, the closing figure being 82. The tractions are little changed, Metropolitan closing at 127¾, an increase of ⅛, while Brooklyn Rapid Transit remains unchanged at 69½. Interborough Rapid Transit was ¼-point lower at the close of the week, the last quotation being 219. The curb market, while showing general gains, exhibited no special features. Transactions were somewhat larger than those of the previous week. Following are the closing quotations of Aug. 15:

NEW YORK

	Aug. 8	Aug. 15		Aug. 8	Aug. 15
Allis-Chalmers Co	18¾	17	Electric Vehicle pfd	25	24
Allis-Chalmers Co. p'd	60¼	59	General Electric	179¼	183¼
American Tel. & Cable	90	90	Hudson River Tel.	..	..
American Tel. & Tel.	138	143	Interborough Rap. Tran	218	218
American Dist. Tel.	29	30	Metropolitan St. Ry.	127⅝	128¼
Brooklyn Rapid Transit	69⅝	70⅛	N. Y. & N. J. Tel.	..	..
Commercial Cable	..	..	Marconi Tel.	..	..
Electric Boat	22	32	Western Union Tel.	93⅝	93⅜
Electric Boat pfd	67	75	Westinghouse com.	166	170
Electric Lead Reduction	..	..	Westinghouse pfd.	..	..
Electric Vehicle	19	19			

BOSTON

	Aug. 8	Aug. 15		Aug. 8	Aug. 15
American Tel. & Tel	133⅛	143⅛	Western Tel. & Tel. pfd	99	*99
Cumberland Telephone	117	117	Mexican Telephone	1¼	1
Edison Elec. Illum.	248	253	New England Telephone	136⅛	135
General Electric	179	183	Mass. Elec. Ry.	17½	18
Western Tel. & Tel.	*18¼	*18	Mass. Elec. Ry. pfd	60	61

PHILADELPHIA

	Aug. 8	Aug. 15		Aug. 8	Aug. 15
American Railways	52½	53	Phila. Traction	..	..
Elec. Storage Battery	82	81	Phila. Electric	8⅞	8⅞
Elec. Storage Battery pfd	..	..	Phila. Rapid Trans.	29⅛	28¾
Elec. Co. of America	11⅝	11¼			

CHICAGO

	Aug. 8	Aug. 15		Aug. 8	Aug. 15
Central Union Tel.	..	..	National Carbon pfd	115	115
Chicago Edison	..	..	Metropolitan Elev. com.	24	24
Chicago City Ry.	*196	*196	Union Traction	..	..
Chicago Tel. Co	..	..	Union Traction pfd.	..	..
National Carbon	60⅛	63			

* Asked.

MANHATTAN-INTERBOROUGH.—The report of the Manhattan Elevated Railway for the twelve months ending June 30, 1905, reflects in part the effect of the Interborough Subway on the earnings of the elevated. It shows for the year a surplus of $8,328,257, as compared with $8,683,136 in 1904, a decrease of $356,479. This is before the charges or dividends are subtracted, and represents the total earnings of the system after deducting running expenses. The report of the entire system shows that the Subway lines earned in three months ending June only $1,349,871, or at the rate of $449,960 in gross. This indicates that during that time the public traveled on the Subway at the rate of about 9,999,000 per month, or over 300,000 per day. Since some other small earnings are included in this total gross, the number of passengers during the last quarter was probably below 250,000 daily. The net surplus of all lines, both Subway and Elevated, during the quarter was some $56,000 less than the surplus of the Elevated lines alone during the same quarter of 1904. This report is very interesting, in view of the fact that the Subway strike was a factor, and because this year is the first in which the Elevated has had the competition of the Subway. It appears that in a normal year the earnings of the Manhattan division of the Interborough Company will be cut. The dividends of 7 per cent on Manhattan are guaranteed by Interborough and any decrease in the net revenues of the Manhattan Company involves only a corresponding increase in the Subway earnings.

U. S. HEATING CONTROL.—At a meeting of the board of directors of the United States Light & Heating Company this week control of that concern passed into the hands of the New York Air Brake Company. Charles A. Starbuck, president of the latter, is the new president of the United States Light & Heating Company, and Edwin Hawley is the new vice-president. John G. Gilbert retires as president. Recently the capitalization of the United States Light & Heating Company was increased from $3,000,000 to $6,000,000. It was incorporated in New Jersey a little more than three years ago, and its object is to furnish light, heat and power for railroad cars by the Moskowitz system; the power is obtained from the car axle. The New York Air Brake Company is fifteen years old and has $10,000,000 capital stock. Dividends at the rate of 8 per cent a year have been paid since 1899. An important asset of the United States Light & Heating Company is its control of the Moskowitz patent. The taking over of control by the Starbuck Company is thought to be a result of the latter's desire to control this patent. The new directors of the United States Light & Heating Company are W. F. Crandell, Clifford Chaffee and C. G. Smith. A. Sanford Adler and Charles S. Furst were re-elected to the board.

ADVANCE IN OTIS ELEVATOR.—The recent advance of about twelve points in the common stock of the Otis Elevator Company was brought about, says the *Wall Street Journal*, by the purchase of less than a thousand shares of stock, indicating a limited floating supply. There have been no unusual developments in connection with the company to account for the advance. Its business in consequence of the revival in the building industry has been benefited, and the financial results so far this year are a little ahead of last year's. This is expected, however, as in the preceding year the building industry in certain parts of the country was rather poor. The common stock has received 2 per cent yearly for the past three years. The last report showed that the company was in good financial condition, the working capital on December 31, 1904, amounting to $3,746,453. The gold notes now outstanding amount to only $400,000, of which $200,000 matures in 1907 and $200,000 in 1908. It is likely that the redemption of these notes will be anticipated, as was done with the amounts falling due in 1905 and 1906.

WESTCHESTER, N. Y. ROAD.—The contract for the grading of the bed for the Westchester Railroad, in the Bronx, a distance of a little less than five miles, has been let to James P. McDonald, contractor, of 42 Broadway, and the work of building the rapid transit electric road will be pushed. The contract calls for the expenditure of something over $1,000,000 in grading alone. Solid embankments and cuts, with concrete arches or steel bridges to carry the road over streets and roads will be the type of construction. It is expected that the construction of the roadbed ready for the laying of track, and exclusive of bridges, will cost in the neighborhood of $3,000,000. Concrete retaining walls will be used on the sides of cuts and fills.

SUSQUEHANNA POWER PLANT.—For the power plant to be built on the Susquehanna River near York, Pa., Harvey Fisk & Sons, of 62 Cedar Street, are managers of the syndicate which is underwriting the $10,000,000 of bonds. William Barclay Parsons, the Interborough Rapid Transit Company's chief engineer, is the chairman of the engineering board under the supervision of which the big plant will be constructed. There will be a large dam across the Susquehanna about twelve miles from York, and its cost will be $2,500,000—one-quarter of the cost of the entire plant. It is expected that the dam will be finished in two or three years. Dr. Cary T. Hutchinson is the chief engineer in charge of construction.

REPORT OF THE CANADIAN GENERAL ELECTRIC.—President W. R. Brock, in his report on the affairs of the Canadian General Electric Company for the year ended December 31, and discussing the present outlook, says: "The profits for the year were $582,519, out of which four quarterly dividends at the rate of 10 per cent per annum upon the common stock, two half-yearly dividends at the rate of 6 per cent per annum upon the preferred stock, and bank interest amounting in the aggregate to $392,763 have been paid. Of the balance the sum of $113,612 has been written off for depreciation, $75,000 transferred to reserve and $1,143 added to the credit of profit and loss account, which now stands at $81,913. The reserve fund is now $1,239,770, plus $100,000 at credit of contingent account, and $81,913 balance at credit of profit and loss, making the total surplus $1,421,683. At the last annual meeting reference was made to the very decided growth in the company's business, in both the electric and foundry departments, and it was intimated that owing to the fact that some especially large contracts were secured during that year, notably in connection with Niagara Power development, there might be some falling off in the volume of business during 1904. The directors are now pleased to say that instead of falling off the business of the company materially increased, and we carry over to 1905 uncompleted contracts amounting to $1,885,000 in the electrical department and $845,000 in the foundry department, or $2,730,000 in all. In addition to these totals, which deal with the past year's business, we can state that the business of the first two months of the current year is the largest in the history of the company for any similar period. From January 1 to March 5 contracts to the amount of $1,007,000 have been closed by the electrical department and $381,000 by the foundry department. These amounts added to the total unfinished business carried forward from 1904 make a gross total of $4,118,000, or over 35 per cent more than the capital of the company. In view of the fact that the company has no bonded indebtedness, its credit has enabled us to borrow money for the purchase of raw materials required for contracts, etc., at a less rate of interest than would be paid in dividends on new capital. Owing to the great and continued growth of the business, however, the working capital required must necessarily increase, and your directors will recommend at a meeting of shareholders to be called for the purpose that application be made for supplementary letters patent increasing the capital stock of the company, and that of such increase new shares to the par value of $900,000, being at the rate of one new share to three old shares of the common stock, be offered, subject to the discretion of the directors to the shareholders at a premium price to be considered later."

POWER FOR NEW YORK CENTRAL.—It is announced by Mr. Joseph G. Robin, who has been identified with the development of the Niagara, Lockport & Ontario Power Company, that the control of the company as well as of the Iroquois Construction Company, which is allied with the power company, had passed to a syndicate headed by H. H. Westinghouse, brother of George Westinghouse, and John J. Albright, of Buffalo. Mr. Robin stated that the New York Central Railroad interests have a share in this syndicate and that in effect the transactions represented the passing of the Ontario Power Company under New York Central control. The Central, which has been making extensive contracts for electrical power at various points along its lines, recently contracted with the Ontario Company for electrical power to be delivered for some distance east from Buffalo. As a result of the change in the control of the Niagara, Lockport & Ontario Power Company, H. H. Westinghouse has been elected a director of that company in place of C. M. Wicker. Gen. Francis V. Greene succeeds to the presidency of the Iroquois Construction Company, and S. M. Clement, president of the Marine National Bank of Buffalo, takes Mr. Robin's place on the board of syndicate managers for the underwriting of the company's securities. It is stated that hereafter interests identified with this bank will attend to the financing of the company. The executive offices, it is announced, will be moved from New York to Buffalo. In a statement in regard to the change of control issued by Mr. Robin reference is made to the contest over the company's franchises that was carried on before the State Legislature. In regard to the struggle of the company for an extension of its original rights, Mr. Robin says in his statement: "Although it was little understood at the time, it now transpires that all the vital legislation wanted by the Lockport Company was actually secured by it."

THE NATIONAL BATTERY COMPANY.—The annual meeting of the stockholders of the National Battery Company was held August 4 at the general offices of the company in Buffalo. The present board of directors was continued unchanged, and the following officers of the company were elected: Mr. John R. H. Richmond, who was formerly treasurer, was elected president. Mr. James McNaughtan, formerly vice-president, was continued in the same office. Mr. Ralph Kimberly, formerly secretary, was appointed to fill the offices of both secretary and treasurer. Mr. Richmond and several associates have taken a large block of the increased capital stock, which will be used in the extension of the business. Mr. R. L. Coleman, formerly president of the company, was elected chairman of the board of directors, and still retains his large interest in the company. Mr. James McNaughtan, under whose management the company has been brought to its present position of strength and activity, was reappointed general manager. The results accomplished during the past year have encouraged the stockholders of the company beyond their expectations. Extensive plans for further development have been made; the field of activity will be broadened, and it is confidently expected that the results for the coming year will more than justify the company in a continuation of the progressive policy that has been inaugurated.

GENERAL ELECTRIC OUTLOOK.—Discussing General Electric affairs, the *Wall Street Journal* says: "If there is no falling off in the demand for electric apparatus the earnings of the General Electric Company for the current fiscal year are expected to show a substantial increase over the preceding year when they were $6,719,000. While the output of the company is large, it is claimed that the margin of profit is smaller than in preceding years. It is estimated that the company is now employing nearly 22,000 men, the largest number in the history of the corporation. In 1901 the company employed 12,000 men; in 1902, 15,000 men; in 1903, 18,000 men; in 1904, 17,000 men, and in 1905, 18,000 men. It would appear that the profits of the company have not been proportionate to the increased output. The earnings of the General Electric Company, in 1902, for example, were $8,555,000; 1903, $10,232,000; in 1904, $7,789,000, and in 1905, $6,710,000. An interest of the company says that it is too early to estimate earnings for the current year, although it is safe to venture a guess that they will be larger than in the preceding fiscal year. According to the last annual report the General Electric Company was well fortified from the standpoint of cash reporting $6,530,000, as compared with $3,289,000 in the preceding year, $3,289,000 in 1903 and $4,058,000 in 1902."

AMERICAN PNEUMATIC SERVICE.—The American Pneumatic Service Co. has acquired the entire bond issue of the New York Mail & Newspaper Transportation Co. The company holds an unrestricted franchise for the streets of New York in perpetuity, also the contract for carrying the United States mail in that city by pneumatic tube at an annual compensation of $415,000. The acquisition of these bonds is considered the key to the New York tube situation, and gives to the American Pneumatic Service Co. the government business for all the large cities of the country excepting Philadelphia, which has only a small, incomplete system of about one mile in length. Messrs. Howard Gould and A. H. Calef, vice-president of the Missouri Pacific R. R., are to enter the directory of the American Pneumatic Service Co. President Dillaway, of the American Co., has been elected president of the New York Company, and Messrs. John Shepard and Oakes Ames have become associated with Messrs. Gould and Calef in the New York Tube Company.

DIVIDENDS.—The Columbus (Ohio) Railway has declared the regular quarterly dividend of 1¼ per cent on the common stock, payable Sept. 1. The board of directors of the American Railways Company has declared a regular quarterly dividend of 1½ per cent (75 cents per share), payable Sept. 15. The directors of the Scranton Railway Company have declared the regular semi-annual dividend of 2½ per cent on the preferred stock, payable Sept. 1.

HUDSON RIVER POWER.—The Hudson River Electric Power Company reports increasing earnings, a statement given out this month showing gross earnings for May of $50,865; operating expenses, $29,264; net, $21,600. For five months the gross was $259,570; operating expenses, $158,815; net, $100,755. The net increase for May as compared with the corresponding month last year was $5,246, and for the five months the gain was $23,060.

UNION SWITCH & SIGNAL.—Advices from Pittsburg say that the advance in Union Switch & Signal is based upon a rumor that an increase in the capital stock is likely in the near future and that it will carry valuable subscription rights to stockholders. Union Switch & Signal common stock, paying 8 per cent on par $50 a share is quoted at $87, while Westinghouse Electric paying 10 per cent on $50 is selling around 84 a share.

ELECTRIC LIGHT GAINS.—Two of the Stone & Webster lighting systems show good gains for June. The Minneapolis General Electric Company showed a net profit for the month of $15,002, or an increase of $3,385 over June, 1904, and the Lowell (Mass.) Electric Light Corporation, $2,686, a gain of $1,189.

ELECTRIC LIGHT EARNINGS.—The Seattle Electric Company reports $208,608 gross for May and $75,834 net. The gross for 12 months was $2,378,040, the net $745,192, and the surplus $443,776, an increase of $51,863 over 1904.

CALIFORNIA GAS & ELECTRIC, San Francisco, shows gross earnings for June of $433,718 as compared with $321,264 last year, a gain of $112,454 for the month. There was a net surplus of $64,256.

General News of the Week

The Telephone.

SEWARD, ALASKA.—Seward, Alaska, has been connected with the outer world by telegraphic communication. With the connection of the Seward and Valdez cable, the Government now has about 2,300 miles of cable in Alaskan waters.

FOWLER, CAL.—Citizens of Fowler have incorporated an independent telephone company and will erect a telephone exchange system. The capital stock is $7,500.

POMONA, CAL.—Because the Sunset Telephone Company has failed to show cause why it should not buy a franchise for its business done in this city the City Council has passed a resolution declaring the poles and apparatus of the company a nuisance and ordered them removed within 30 days. The company must now procure a franchise under the Broughton law or fight the city in the courts.

BOISE, IDAHO.—The Pacific and Idaho Northern Telegraph & Telephone Company has filed articles of incorporation at Boise. Capital $100,000. Incorporators are L. C. Van Riper and Joseph M. Dever, of New York, and Edgar M. Heigho, Lewis Hall and Frank Gribbon, of Weiser, Idaho.

CHICAGO, ILL.—The Chicago Telephone Company's gain in July was 1,346. The total now in use is 131,754.

LEMONT, ILL.—The Interstate Telephone Company is installing its exchange here and has already put in a number of telephones.

CAIRO, ILL.—The Bell Telephone Company is contemplating establishing service in Mounds, Tamma, Sandusky, Hodges, Park, Cache, Olive Branch and Thebes.

CHICAGO, ILL.—According to a director of the Chicago Telephone Company there will be no necessity of a new issue of stock this year. The matter was discussed recently, and it was found that the company has enough money to carry on all extension work now contemplated. Earnings are increasing steadily, and a certain percentage of these is being used for renewals and extensions.

CHICAGO, ILL.—The Chicago Telephone Company reports on new instruments for July show there were 1,346 installed during the month, of which 1,012 were in the city and 334 in the country. The total now reported in service is 131,754, a gain of 13,861 since January. During 1904 the total gain for the year was 16,706, and if the present ratio is maintained for the rest of 1905 officials expect the increase to reach a total of over 20,000.

LAFAYETTE, IND.—A telephone line is being built at Junction City for local business men.

FORT WAYNE, IND.—John A. Dungan, assistant general manager of the Fort Wayne Independent Telephone Company, has resigned to accept the superintendency of the Sioux City (Ia.) telephone system.

WASHINGTON, IND.—The Daviess County Home Telephone Company has authorized and issued $100,000 preferred stock. This company has been very prosperous and is now extending its field and putting in new and modern equipment.

MARKLE, IND.—The Markle Telephone Company has increased its rates from $1 and $1.50 to $1.50 and $2. It is claimed that the increase has nothing to do with the sale of the United to the Bell, but resulted from local conditions.

WEST TERRE HAUTE, IND.—The West Terre Haute Telephone Company has filed articles of incorporation with the Secretary of State. Burton Cassiday, D. S. Gonnell and H. H. Knipe are the directors. The capital stock is $10,000.

FRANKTON, IND.—The Central Union Telephone Company is establishing a telephone system in this city, to cost $10,000. In order to build up a business and successfully compete with the home company the Central Union proposes to reduce the rate to 50 cents a month.

HUNTINGTON, IND.—The Central Union Telephone Company, which recently came into possession of the United Telephone Company's property in Huntington and adjoining counties, has announced that $20,000 will be spent in overhauling the system. A large amount of cable will be strung and much of the work will be placed under ground. Four new rural lines will be built and exchanges in the Southwestern part of the county will be connected with the Huntington system.

FORT WAYNE, IND.—George W. Beers gave out a statement a few days ago to the effect that the independents contemplated cutting off the United from all connections and gave as a reason therefor that the manager was discriminating against the independent toll service. This statement brought out a rejoinder from Manager Sale, who said: "Independent companies will not be permitted to sever their relations with the United Telephone Company in retaliation for the United signing a sublicense contract with the Bell, and the minute one of them tries to cut its wires it will be met with an injunction." Mr. Sale said: "If the United States Company of Ohio has severed its connection with us, as stated by Mr. Beers, we have received no notice of it. We are still carrying on business with them, that is certain. We have time contracts with the independent companies, and those contracts are valid and will be enforced," said he. "The statement of Mr. Beers that the business the United has been handling over the independent companies has been rapidly decreasing since our connection with the Bell is not correct. On the contrary during the month of June we turned over to them more business than in any previous month, and it is our interest to turn our toll-line business to the independents, as it is more profitable than giving it to the Bell. There is no danger of our plant being isolated by other independent companies taking it from us as it would hurt them more than us. Other companies over the State will soon be operating under sublicense of the Bell, and two companies already sustain that relation, although their officers deny it. Nothing more has been done by the independents toward invading the territory of the United than the connecting up of a small line through Marion to a small town near by, and this is insignificant. Most of this talk of invasion and cutting of connections come from promoters and contractors." Mr. Beers says: "There will be some interesting developments in the situation very soon. I do not wish to be drawn into a controversy with the paid agents of the Bell. The United Telephone Company, from what Mr. Sale says, is fully alive to the consequences of being cut off from the independents, which have 165,000 telephones to 33,000 of Bell telephones in the State."

LOGAN, IA.—A mutual telephone company will be organized at Logan, as a result of the old company's refusal to reduce rates.

GLENWOOD, IA.—The Mills County Telephone Company has started to run a new line from Malvern to Henderson. The company is figuring on a number of other lines.

WAVERLY, IA.—A deed has been filed from trustees of the U. S. Telephone Company conveying all the property owned by that company to the Corn Belt Telephone Company. The latter is the name of the new corporation which now owns and operates what was formerly known as the Cedar Valley Telephone Company. The consideration named in the deed was $55,000. The company owns and operates telephone lines in 13 counties.

COUNCIL BLUFFS, IA.—On each bank of the Missouri River, two miles south of Council Bluffs, the Independent Telephone Company of this city will erect towers of steel 125 feet high for the purpose of stretching cables across the stream to connect Council Bluffs with South Omaha. Omaha, which has no independent exchange, will be left out, while Lincoln, Sioux City and Des Moines, its trade rivals, will get the benefit of the interstate connection. The towers will be of sufficient height to be used as wireless telegraph stations, and there is some likelihood that they will ultimately be made to serve that purpose.

NESTORIA, MICH.—The Michigan Bell Telephone Company will build a toll line to Nestoria.

MARQUETTE, MICH.—A merger by which the Michigan State Telephone Company will absorb the Marquette County Telephone Company, a local concern, is pending and is expected to be successfully concluded.

GRAND RAPIDS, MICH.—The capital stock of the Citizens' Telephone Company will be increased from $2,000,000 to $3,000,000 for the purpose of erecting new exchanges and improving the old ones. The present board of directors was re-elected.

GRAND RAPIDS, MICH.—Grand Rapids and Detroit capitalists are interested in a new independent telephone company. The new company will be known as the Standard Telephone Company and will have lines and stations in St. Joseph, Grand Rapids, South Haven and Benton Harbor. The consolidation of the Twin City Telephone Company with the Michigan line was effected a year ago.

MARQUETTE, MICH.—Should a deal, now in progress, be concluded, the telephone business in Marquette County will again be monopolized by one concern, as was the case before the Marquette County Telephone Company was organized by home capitalists ten years ago. The Michigan State Company is negotiating for the stock of the county system, and there is reason to believe the deal will be successful. The local concern has been paying annual dividends of 10 per cent. on a capitalization of $60,000.

ST. PAUL, MINN.—The Twin City Telephone Company has been granted a number of privileges for the construction of overhead lines.

DEERWOOD, MINN.—The Deerwood Baylake Telephone Company has been formed with a capital of $3,000, by A. N. Gray and David Archibald.

SACRED HEART, MINN.—The Farmers' Consolidated Telephone Company has been formed with a capital of $50,000, by Hans Berger and N. J. Holly.

ST. PAUL, MINN.—The Villard Telephone Company, with a capital of $10,000, has filed articles of incorporation. The incorporators are C. F. Angell, E. L. Scovelle, B. A. Angell, L. F. McGray, W. R. Burter, A. E. Clark and J. W. Burter.

HATTIESBURG, MISS.—The City Council has granted a franchise to J. A. and S. A. Jones and George D. Winter, of Chicago, to build an underground telephone system, at a cost of $125,000.

BRAXTON, MISS.—The Braxton Telephone Company has been organized. Capital, $15,000. It is incorporated by J. H. Gibson and L. D. Spell.

ST. LOUIS, MO.—The recently formed Kinloch-Bloomington Telephone Company, which is a combination of the lines of the old Home Telephone Company and the long-distance lines, controlled by the Kinloch Company of St. Louis, has filed a trust deed to secure the issue of $500,000. The deed is made to the American Trust and Savings Bank, of Chicago.

BOSEMAN, MONT.—The Rocky Mountain Bell Telephone Company will erect an exchange building here.

TRENTON, N. J.—The Rio Janeiro Telephone Company has been incorporated with a capital stock of $1,500,000. The incorporators are Charles H. Sisson, Isaac S. Gilbert, Frank H. Richmond and Henry A. Robinson.

STEWARTSVILLE, N. J.—The Stewartsville Telephone Company has been formed by Benjamin F. Strader, Stewart A. Shillinger, Michael F. Dowling, John C. Boyer, William Y. Bush and others, all of Stewartsville. The capital stock is $10,000.

NEW YORK, N. Y.—The Ontario & Steuben Telephone Company has been organized, by J. E. Lynn and W. H. Hisel. Capital $40,000.

TROY, N. Y.—The Commercial Union Telephone Company of this city has secured a controlling interest in The Co-operant Telephone Company, of

Whitehall, and added these lines to its system, which now covers the entire eastern section of the State, as well as territory in adjoining States. The Whitehall Company has a capital stock of $50,000 and operates over 1,200 telephones in the territory from Whitehall northward to Ticonderoga and eastward to Fair Haven, Hydeville, Castleton and Poultney.

MICHIGAN CITY, N. D.—The Michigan City Telephone Company has been formed with a capital of $5,000, by Edward Litton, Larimore, N. D., and J. H. Lerrett.

COLUMBUS, OHIO.—The Yorkshire Telephone Company has been incorporated by C. D. Grove and E. A. Fisher. The capital is $10,000.

MILLERSBURG, OHIO.—The Millersburg, Wooster & Orrville Telephone Company will erect a three-story building on Mad Anthony Street in this place.

HAMILTON, OHIO.—The Cincinnati Bell Telephone Company has completed plans of a new 2-story telephone exchange for Hamilton at an estimated cost of over $40,000.

BUCYRUS, OHIO.—The Bucyrus Telephone Company has installed a new $3,000 switchboard. The new board has 960 numbers on it divided into 12 blocks of 80 numbers to the block. It accommodates six operators, each operator working 160 numbers.

LORAIN, OHIO.—Negotiations have been opened by the Bell Telephone Company, with a view to buying out the Black River Telephone Company which now enjoys a monopoly of the Lorain business.

CLEVELAND, OHIO.—Under the profit-sharing arrangement existing between the Cuyahoga Telephone Company and its employes, a distribution of funds has just taken place amounting to 7 per cent. of salaries for the six months ending June 30, a gain of ½ of 1 per cent. over the distribution six months ago and 1 per cent. over that of a year ago.

DAYTON, OHIO.—In order to be able to accommodate the enormous increase in business, extensive improvements are contemplated by the management of the Central Union Telephone Company. If the plans now being considered are carried out, the added facilities will necessitate the expenditure of about $300,000. One of the most important parts of the improvements will be the extension of the conduit system, and the elimination of telephone poles wherever possible. The overhead cable service will be extended.

WILKESBARRE, PA.—Plans are being prepared for the erection of the new building for the Pennsylvania Telephone Company.

DOYLESTOWN, PA.—Residents of Nockamixon have organized the Nockamixon Telephone Company, with an exchange at Revere. The officers are: President, William O. Ealor, Kintnersville; secretary, Thomas L. Henry, Kintnersville; treasurer, T. M. Moyer, Ferndale.

RIMERSBURG, PA.—The Rimersburg Bell Telephone Company has been incorporated. Capital $5,000.

NASHVILLE, TENN.—E. T. Mitchell and C. A. Thatcher, of Chicago, are applicants for a telephone franchise in Nashville, Tenn.

LAREDO, TEX.—The Southwestern Telegraph & Telephone Company will install an entirely new outfit in Laredo as soon as it can be manufactured.

TIMPSON, TEX..—The Timpson Telephone Company has been formed with a capital of $10,000 by J. B. Bussey and Frank Bussey.

MONTELL, TEX.—The Citizens' Telephone Company has been formed with a capital of $1,000, by A. S. Baylor and T. S. Sutherland.

HUMBLE, TEX.—The Humble Telephone Company has been formed with a capital of $2,000. Incorporated by W. Campbell and W. M. Abbey.

AUSTIN, TEX.—The Commercial Telephone Company of Texas has been sold at public auction for $110,000, having been bought in by a committee representing the bondholders, most of whom are located in Kentucky, Ohio and Indiana. The sale was the result of a suit brought by the stockholders to secure interest on $400,000 worth of bonds, which was defaulted. It is announced that the company under the new organization will proceed at once to enlarge and newly equip the company's property so as to cover Texas, Louisiana, Arkansas and the Indian Territory.

LYNCH'S, VA.—Lynch's Telephone Company, of Lynch's, Campbell County, has been organized with a maximum capital of $5,000, minimum $500. W. S. Frazier is secretary and treasurer.

TACOMA, WASH.—The new long-distance telephone line, of the Sunset Telephone Company, between Tacoma and Spokane, has been completed, and opened to the public. There are but three stations on the line—Tacoma, Seattle and Spokane. It is built over the mountains and is shorter by 100 miles than any other telephone or telegraph line between the cities. Heretofore all messages sent to Spokane from either Tacoma or Seattle had to be sent by way of Portland, but the completion of the new line gives direct connection.

CHARLESTOWN, W. VA.—The Jefferson County Telephone Company has its line up from Charlestown to Harpers Ferry, and the work is now being actively pushed. The lines of the company will connect Charlestown, Harpers Ferry and Hagerstown, Shepherdstown and Martinsburg. The central is now being installed in Harpers Ferry. There are 269 stockholders in the company, all citizens of Jefferson County, among them being banks, bank presidents and directors, real estate agents, insurance agents, doctors, lawyers, merchants and farmers. The company is so planned that each stockholder on taking $25 of the preferred stock is entitled to a residence telephone at $10.50, or a business telephone at $16.50. The company is also offering to farmers the opportunity of building their own lines into the towns, and on such farmers' lines, farmers will be able to have first-class telephone service at $6 a year.

BLAIR, WIS.—The Preston Farmers' Telephone Company has been formed by H. C. Shepard, A. P. Peterson and Guy Shepard. The capital stock is $5,200.

Electric Light and Power.

ENSLEY, ALA.—The City Council has defeated the resolution to call an election to vote on issuing bonds for a municipal electric light plant.

ANAHEIM, CAL.—C. A. Copeland, of Los Angeles, has submitted to Council a report on improving and enlarging the water works and electric light plant. He estimates the cost at $40,000.

STAFFORD SPRINGS, CONN.—Judge Reed has extended the time four months for the local electric light company to continue to do business under the receiver.

DERBY JUNCTION, CONN.—The New Haven road is to establish a power-house at this place and work all switches, lights, etc., by electricity.

LAKELAND, FLA.—The Council has under consideration the question of increasing the capacity of the electric light plant. W. B. Clay is superintendent.

ST. AUGUSTINE, FLA.—Thos. R. Osmond and associates have applied for a franchise for the St. Johns Light & Power Company, which proposes to manufacture gas, electricity or other illuminants for light and power and to construct and operate electric railways.

LAGRANGE, GA.—Ludwig & Co., of Atlanta, have secured the contract to construct the municipal electric light plant for Lagrange.

MONROE, GA.—The Electric Supply Company, of Savannah, has secured the contract to construct the municipal electric light plant for about $20,000.

WINDER, GA.—It is proposed to install at the city electric light plant a 30-kw. alternating-current generator, switchboard, etc. D. W. Robertson is superintendent.

FRANKFORT, IND.—It is proposed to add a 120-kw., alternating-current generator to the city electric light plant. J. T. Small is superintendent.

VALPARAISO, IND.—The Valparaiso (Ind.) Light & Fuel Company sold its gas and electric light plant to Charles H. Geist, of Chicago, for $60,000.

WORTHINGTON, IND.—The Indiana Water & Light Company contemplates installing a new arc light system; the adoption of meters and the extension of lines.

NORTH VERNON, IND.—It is proposed to install at the city electric light plant before the fall, an additional 150-kw. unit and boiler. A. B. Berkshire is superintendent.

JASONVILLE, IND.—The Jasonville Electric Light Company will receive bids for the construction of an electric light plant. The incorporation of this company was noted last week.

NOBLESVILLE, IND.—The S. M. Smith Company, owner of the electric light plant, proposes to change from the open arc to enclosed direct-current, 6.6 ampere lamps and rebuild the pole lines. O. N. Eiler is manager.

MUNCIE, IND.—Among the improvements contemplated by this city is the rewiring of the city electric lighting system and the purchase of 100-ft. stacks. Harry L. McCullough is superintendent.

COLUMBUS, IND.—The Columbus Street Railway & Light Company contemplates constructing a power house, making extensions to the street railway and electric light systems and the addition of a heating plant. R. F. Gottschalk is president.

OTTAWA, ILL.—The Ottawa Power Company has been incorporated with a capital of $5,000. Jas. A. Sheldon is one of the incorporators.

ALPHA, ILL.—The Tri-County Light & Power Company expects to extentd its lines to North Henderson and Viola. W. I. Taze is manager.

CLAYTON, ILL.—It is proposed to purchase at once a 60-kw. alternator for the municipal electric light plant. I. M. Brown is superintendent.

BLOOMINGTON, ILL.—The Peoples Gas Electric & Heating Company will probably rebuild its plant in the course of a year. J. N. Moncrieff is superintendent.

CHICAGO, ILL.—Shepley, Rutan & Coolidge are preparing plans for the enlargement of the Hyde Park plant of the Commonwealth Electric Co. The estimated cost of the work is $150,000.

DENISON, IA.—The Denison Electric Light & Power Company contemplates installing a 50 or 60-kw. unit and a boiler.

FORT DODGE, IA.—The Illinois Central is contemplating the installation of an independent electric lighting plant at this city.

BEDFORD, IA.—The Bedford Light, Heat & Power Company proposes to install two new 60-cycle alternating-current generators, one of 40-kw. and the other 100-kw. capacity. M. L. Burt is president.

MADRID, IA.—The Madrid Electric Light & Power Company wants estimates on installing storage batteries of sufficient capacity to carry lights after 12 o'clock and also carry a day current. W. Zenar is chief engineer.

ALBIA, IA.—The Albia Electric Light & Power Company has just started a day circuit, and is in the market for small direct-current motors of ½ to 25 horse-power, 110 and 220 volts. A. R. Jackson is the purchasing agent.

KEOKUK, IA.—The Keokuk & Hamilton Water Power Company proposes to develop electric power at the foot of Des Moines Rapids and transmit it to cities in the States of Iowa, Illinois and Missouri. It is proposed to develop a minimum of 60,000 horse-power. The estimated cost of proposed work is $6,000,000. John N. Irwin, of Keokuk, is president; R. R. Wallace, of Hamilton, Ill., is secretary, and Lyman E. Cooley, of Chicago, Ill., is consulting engineer.

HAYS CITY, KAN.—The Hays City Electric Light & Power Company proposes to install a 65-kw., 1,100-volt alternator.

GARDEN CITY, KAN.—The Garden City Electric Company will soon add to its equipment a 75-kw. dynamo and a 100-hp. Corliss engine.

LINCOLN, KAN.—A committee has been appointed, including A. Marshall, J. Albert Smith and others, to investigate and report on the question of constructing water works and an electric light plant.

PIKEVILLE, KY.—The Pikeville Electric Light Company will install a 100-kw., 250-volt, direct-connected generator.

MIDDLESBOROUGH, KY.—The Middlesborough Electric Light, Heat & Power Company may move its plant to the water works; if not, it is proposed to install a dynamo at the present station and a motor at the water works station. The company would like information about cost of iron poles and underground conduits. Address W. M. Todd, manager.

HOLYOKE, MASS.—About $9,500 will be spent on improvements for the municipal electric light plant.

GLOUCESTER, MASS.—The Gloucester Electric Company proposes to add to its equipment a 500-kw. Curtis steam turbine.

PLYMOUTH, MASS.—At the annual meeting of the Plymouth Electric Light Company the following officers were elected: James N. McCoy, president; Frank C. Calley, treasurer; George H. Adams, clerk; James N. McCoy, Fred P. Weeks, Warren G. Chase, George H. Adams and Frank C. Calley, directors.

LEWISTON, ME.—The Alfred Light & Power Company, which is controlled by the Atlantic Shore line, has taken over the Linscott and Ester water privileges, which were purchased by Bodwell Brothers some time ago. In developing these privileges they will make one privilege at the Ester dam and that will give them a water power capable of developing 800 horse-power.

LONACONING, MD.—The Lonaconing Electric Light & Power Company expects to install a 90-kw. dynamo. Wm. Atkinson is manager and purchasing agent.

ADRIAN, MICH.—The Citizens' Light & Power Company contemplates installing a 500-hp. turbine and boiler outfit.

MASON, MICH.—A new boiler, engine, alternating-current dynamo, switchboard, etc., are needed for the municipal electric light plant. R. E. Darling is superintendent.

HASTINGS, MICH.—The Hastings (Mich.) Gas Company has sold its plant to the Thornapple Electric Company which will hereafter be known as Thornapple Gas & Electric Company.

HOUGHTON, MICH.—The Houghton County Electric Light Company has elected the following directors: Henry G. Bradlee, James R. Dee, Waldo E. Forbes, Henry R. Hayes, William L. Putnam, Russell Robb, Charles A. Stone, Edwin S. Webster and Charles D. Wyman.

BIG RAPIDS, MICH.—The Michigan Heater Company, which is rebuilding the burnt portion of its plant for the Hanchett Sewage Works, is also figuring on generating electric power to supply its own needs, the needs of the Hanchett Sewage Works and also to give the city a day current.

CASS CITY, MICH.—Surveys are now being made for the construction of a dam for the municipal electric light plant, about 4 miles southwest of Cass City, on Cass River. If the report is satisfactory the water power plant will be built next spring, for which a new equipment of dynamos, motors and pumps will be needed. Wm. N. Strube is superintendent and chief engineer.

PONTIAC, MICH.—The Pontiac Savings Bank and the Citizens' Savings Bank, of Holly, have taken possession of the Holly Milling Company at Holly. This also includes the Holly Electric Light & Power Company. C. H. S. Poole, president and majority stockholder of the company, it is said, is indebted to the banks in the sum of $15,000.

GRAND RAPIDS, MICH.—The Cascade Electric Company, which has acquired flowage rights on the Thornapple River, is seeking a franchise in the city to furnish commercial lighting and power. The proposed franchise prohibits the company from charging more than 15 cents per kw-hour for lighting and 4 cents per hp-hour for power, and forbids the company disposing of the franchise to a competitor. The management of the enterprise is vested in Frederick C. Miller, and associated with him are Ernest A. Stowe, Stephen Sears, Robert W. Irwin, A. Hompe, C. C. Follmer, Henry Idema, Walter C. Winchester and Guy W. Rouse, all Grand Rapids men.

ANN ARBOR, MICH.—The Washtenaw Light & Power Company, of this city is to be united with the light and power system of Detroit, and within a few months a feed wire will be run from the Geddes plant to the county line to connect with a feed wire from Delray. The companies concerned are all controlled by the North America syndicate, which is preparing to develop extensively the power of the Huron River.

MUSKEGON, MICH.—The Shaw Electric Crane Company is planning to drive all of the machinery of its great shops at Muskegon Heights by electric current, to be furnished by the Grand Rapids-Muskegon Water Power Electric Company. The machinery is now driven electrically from the Shaw Compan's own plant. A new 400-hp. rotary converter will be put in by the Shaw Company.

STARBUCK, MINN.—Mr. A. H. Dreyer, superintendent of the village lighting system, reports the addition of a new 30-kw dynamo and a 50-hp engine.

MARSHALL, MINN.—It is proposed during the coming year to renew the entire equipment of the municipal electric light plant. E. Simmons is superintendent.

HOUSTON, MISS.—Bids will be received until Sept. 1 by J. M. Griffin for $13,500 water and light bonds.

SARDIS, MISS.—The Panola Electric Light & Power Company expects to put in a series arc light circuit for street lighting about Jan. 1 next.

GLOSTER, MISS.—This city has in contemplation the installing of duplicate dynamos and engine at the city electric light plant. Howard E. Pigford is manager.

COLUMBIA, MO.—It was voted to issue $10,000 water and electric light bonds. John S. Bicknell is City Clk.

JOPLIN, MO.—The Spring River Power Company proposes to construct a new power plant. The Arnold Company, of Chicago, Ill., is the engineer.

BUTTE, MONT.—Saml. T. Hauser, of Helena, former Governor of Montana, is interested in the construction of a second dam across the Missouri River. It is proposed to transmit the power to Anaconda.

YORK, NEB.—The York (Neb.) Electric Light & Power Company, and the York Gas Company have effected a consolidation and will be known as the York Electric Light, Gas and Power Company. C. A. Haas of Omaha has been elected president and J. A. Peffer manager.

MILFORD, N. H.—Murphy Brothers are soon to put in electric power at their granite works.

WOODSTOWN, N. J.—The Woodstown Ice & Cold Storage Company, which lights this town, proposes to install a larger dynamo and engine. C. F. Moore is manager.

ATLANTIC HIGHLANDS, N. J.—At the municipal electric light plant, it is expected to change over to alternating enclosed arcs and the alternating system to 2,000 primary and 60 cycles. A new dynamo and engine will also be installed. F. E. Price is superintendent.

RATON, N. M.—The Raton Electric Light & Power Company will install a new boiler, engine and a 150-kw alternating-current dynamo.

ROSWELL, N. M.—The Roswell Electric Light Company has in contemplation the purchase of an entire new equipment for its power house. J. H. Cook is superintendent.

LOWVILLE, N. Y.—The Wetmore Electric Company proposes to install a 500-kw. alternator and a pair of water wheels. L. Wetmore is manager.

PENN YAN, N. Y.—The Yates Electric Light & Power Company proposes to rebuild and install two 400-hp. Victor turbines of the horizontal type, direct connected to two 150-kw. generators.

LOCKPORT, N. Y.—The citizens of Lockport are considering a proposition just made by the Albright, Green and Hayes interests of Buffalo, representing the Ontario Power Company, to furnish to the residents of Lockport electric power at $16 per horse-power. They purpose to furnish power in blocks of 100 horse-power at the transmission station on the Ernest farm. The offer is receiving favorable consideration from the business interests of the city.

FAYETTEVILLE, N. C.—Electric light bonds amounting to $30,000 have been sold.

ROCKINGHAM, N. C.—It is proposed to install a new dynamo at the municipal electric light plant.

RALEIGH, N. C.—The Raleigh Electric Company proposes to construct two miles of railway and extend the lighting system. W. J. Andrews is president and manager.

MORGANTON, N. C.—W. A. Mauney, of Kings Mountain, and J. M. Torrence, of Morganton, will organize a company to construct an electric light plant and erect a cotton factory.

STRASBURG, OHIO.—Contracts are being let by the Strasburg Electric Company for doubling the capacity of the plant.

MOUNT VERNON, OHIO.—Mr. Carl Hoster and Samuel Blumenthal, of the Hoster Brewing Company, intend to install a large electric plant.

ADA, OHIO.—The Ada Water, Heat & Light Company will require about 10 miles of construction material for its extension to Algiers. B. S. Young is secretary and manager.

TOLEDO, OHIO.—Frank I. Consaul, chief engineer of the Board of Public Service, estimates the cost of constructing a municipal electric light plant at $470,400.

CAREY, OHIO.—At the village electric light plant it is proposed to add a 75-kw. alternating-current generator and a separate engine for the arc lighting. Harry C. Fink is manager.

OBERLIN, OHIO.—The Oberlin Gas & Electric Light Company, of Oberlin, has been incorporated with a capital of $10,000, by W. B. Whiting, C. F. Brooks, A. J. Sperry and others.

WEATHERLY, PA.—The Town Council has decided to construct a new electric light plant.

COLUMBIA, PA.—The Lancaster County Electric Light & Power Company has decided to construct a power station at Columbia.

HYNDMAN, PA.—The Hyndman Electric Light, Heat & Power Company expects to install a larger engine in the near future. N. A. Blair is president.

HUGHESVILLE, PA.—The Citizens' Electric Light & Power Company is preparing plans for a power plant. John B. Fox is secretary.

KUTZTOWN, PA.—This borough has decided to issue bonds to the amount of about $8,000 for the construction of an electric light plant.

SOMERSET, PA.—The Somerset Electric Light, Heat & Power Company will add a 300-kw. alternator and a 600-hp. engine. J. M. Bricker is manager.

SHAMOKIN, PA.—The Shamokin Light, Heat & Power Company expects to replace its present machinery with 600-kw., 60-cycle, 2,200-volt, 2-phase generators.

TREMONT, PA.—The Tremont and Pine Grove Electric Light & Power Company proposes to extend its system to Pine Grove, a distance of 6 miles, and to Donaldson, 1 mile. Geo. Bernd is superintendent.

WILLIAMSPORT, PA.—The Lycoming Electric Company has decided to lay conduits for underground wires in connection with the building of its proposed new power plant on Hepburn St. Ernest H. Davis is manager.

READING, PA.—The Reading Illuminating Light Company has been incorporated with a capital of $100,000. The directors are. Gustav Ulbricht, of Brooklyn, N. Y.; Ralph W. Gifford, of New York, N. Y., and Dan'l J. Driscoll, of Reading.

BARNET, VT.—The Pioneer Electric Company will install new water wheels this fall. A. S. Hunt is manager.

The Electric Railway.

ATLANTA, GA.—A charter has been granted to a company proposing to build an electric railway from Atlanta to Macon, to be known as the Atlanta-Macon Interurban Railway Company, with a capital stock of $100,000. T. B. Felder, Atlanta; C. C. Canfield, Chicago; and others are the stockholders.

FREEPORT, ILL.—The power plant of the Freeport Railway, Light & Power Company was seriously damaged by fire a few days ago. The loss is estimated at $50,000, and is covered by insurance.

KANKAKEE, ILL.—The Kankakee Street Railway and Electric Park have been sold to a syndicate consisting of R. A. McCracken and E. D. Risser, of Paxton, and C. O. Patton, of Chicago. The price was $100,000.

EDWARDSVILE, ILL.—The Carlinville, Alton & St. Louis Railway Company, of Jerseyville, has been incorporated. The capital stock is $2,000. The incorporators are Andrew W. Cross, Jos. M. Page, Joseph W. Becker, and John C. McGrath, of Jerseyville; Aaron O. Auten, of Chicago; Robert Curdie and June M. Rhoades, of Alton.

COLUMBUS, IND.—The plan to build an electric railway from Columbus to Hope, Hartsville and Greensburg has been revived and is now well under way.

EVANSVILLE, IND.—Evansville and Rockport, Ind., capitalists have held a meeting here to discuss the building of an electric line from either Marengo or English, Ind., to White Sulphur Springs.

NEW CASTLE, IND.—The New Castle-Indianapolis Construction Company has filed articles of incorporation with the Secretary of State. The capital stock is $50,000. The object of the company is to build the Indianapolis, New Castle & Toledo Traction Line.

ROCKPORT, IND.—S. O. Graham and associates are promoting an electric railway from a point on the Southern Railroad to White Sulphur Springs. The line will be twelve miles long and afford service to a territory destitute of transportation except by hack line.

RICHMOND, IND.—Six sub-stations are being installed on the line of the Indianapolis & Eastern Traction Company. The new stations are to be located at Cumberland, New Castle, Charlottsville, Lewisville and Cambridge City, the one at the latter place being portable.

DES MOINES, IA.—The State Board of Health of Iowa is considering the practicability of asking the Legislature to pass laws requiring steam and electric lines to disinfect passenger cars at their terminals.

PARIS, KY.—The Nicholas County fiscal court has granted the Paris-Carlisle-Maysville Interurban line the right of way through the county.

BANGOR, ME.—The property and franchises of the Penobscot Central Railroad Company, which has been operating an electric railway from Bangor to Kenduskeag, Corinth and Charleston, will be taken over by the Bangor & Northern Company, which has been organized in Bangor. The officers of the new company are: President, John R. Graham; vice-president, Charles F. Woodward; treasurer, F. D. Oliver; clerk, E. C. Ryder.

HAGERSTOWN, MD.—The Hagerstown Electric Railway Company will build a line from here to Waynesboro and Pen Mar, in Franklin County, a distance of 10 miles. The company also proposes to build an electric railway from Boonsboro to Sharpsburg, through the Antietam battlefield, a distance of six miles.

WORCESTER, MASS.—Something unique in street railway excursions in New England is the proposition of the Boston & Worcester Street Railway to take a party from Worcester to Salisbury Beach on a two-days' excursion.

GRAND RAPIDS, MICH.—The Consolidated Railway & Light Company, of Philadelphia, is negotiating for the lease of the municipal electric light plant. Their offer is not considered favorably by the city officials.

MORRISTOWN, N. J.—The Morris County Traction Company has made a mortgage to the Trust Company of America, of New York, to secure $3,000,000 5 per cent 30-year bonds, redeemable at 110. The company has now in operation 7½ miles of road from Wharton to Rockaway. It proposes to build about 60 miles of additional road through Springfield, Union and Milburn.

OGDENSBURG, N. Y.—President Hawkins of the Ogdensburg Street Railway Company has submitted to the directors a plan to connect this city with Gouverneur by trolley. An extension to Waddington and to Morristown, up the St. Lawrence River, is also planned.

PENN YAN, N. Y.—An application will soon be made for a certificate for the construction of an electric railway on the west side of Keuka Lake, to run from Hammondsport to Gibson's Landing and thence to Branchport, there to connect with the Penn Yan, Keuka Park & Branchport Electric Railroad.

CALGARY, N. W. T.—The Calgary Street Railway Company has asked for permission to proceed with the construction of an electric street railway.

LORAIN, OHIO.—The City Council has granted a franchise to the Lorain Street Railway Company for the extension of its line to the river.

PHILADELPHIA, PA.—The Germantown & Chestnut Hill Belt Line has asked Councils for permission to lay tracks which will cover nearly the whole of Germantown and Chestnut Hill.

KNOXVILLE, TENN.—The Knoxville Traction Company and the Knoxville Electric Light & Power Company will be merged into one concern under the name of the Knoxville Railway & Light Company. The capital stock will be $2,000,000.

SALT LAKE CITY, UTAH.—After Judge George G. Armstrong had issued and dissolved an order restraining Councilman Rulon S. Wells, W. J. Tuddenham and A. E. Barnes from voting for the ordinance cosolidating and extending the franchises of the Utah Light & Railway Company, the Salt Lake City Council passed the ordinance, 8 to 7.

New Industrial Companies.

THE HAWKS ELECTRIC COMPANY has been incorporated at Goshen, Ind., with a capital of $36,500, by F. E. Hawks, O. C. Cover, and others.

DODD & STRUTHERS have incorporated at Des Moines, Ia., with a capital of $750,000 to continue the business of making copper cable, lightning rods, etc., established eight years ago.

THE ELECTRIC WATER PUMPING AND FILTER COMPANY, of Kerhonkson, N. Y., has been incorporated with a capital of $600,000. Directors: Arthur J. Baldwin, East Orange, N. J.; C. S. Batt, Tarrytown; Edward T. Magoffin, New York.

THE UNIVERSAL ELECTRIC STORAGE BATTERY COMPANY, of Wilmington, Del., has been incorporated with a capital stock of $500,000; the capital stock in Illinois is $125,000.

THE BATTERY SUPPLIES COMPANY, of Newark, N. J., has been incorporated with a capital of $100,000. Incorporators: James W. Gladstone, Eben G. Dodge and Elisha E. Hudson.

THE SMITH STORAGE BATTERY COMPANY has been incorporated at Zoar, O., capital $30,000, by John Bimeler, Peter Bimeler, Lewis Zimmerman, Malcolm O. Smith, Edwin C. Knapp.

THE AMERICAN CORRESPONDENCE SCHOOL OF ELECTRO-THERAPEUTICS has been incorporated at Chicago by A. D. Gash, James H. Hooper and Page V. Lyon. The capital is $2,500.

THE CLARK ELECTRIC & MANUFACTURING COMPANY, of New York, has been incorporated to conduct business as electricians and mechanical engineers; capital, $100,000. Directors: G. W. Ryburg, T. J. Conry, and C. P. Nevin, of New York.

Legal.

BALTIMORE FRANCHISES.—Mr. Alexander Brown, the well-known banker, who was recently unsuccessful in his efforts to restrain the Maryland Telephone Company from engaging in the electric lighting and power business in Baltimore, has instituted suit to prevent the electric lighting and power franchises of that company from being turned over to the Baltimore Electric Power Company without proper compensation. The suit is against the Baltimore Electric Power Company, the Maryland Telephone & Telegraph Company, Mr. George R. Webb, former president of the Maryland Telephone Company and promoter of the Baltimore Electric Power Company; Mr. H. W. Webb, president of the Maryland Telephone Company, and Mr. David E. Evans, vice-president of the Maryland Telephone Company and president of the Baltimore Electric Power Company.

CURIOUS LIGHTING LITIGATION.—At Springfield, Ill., injunction proceedings are pending in the Sangamon Circuit court as a result of the lighting controversy which has been in progress for several weeks. Judge James A. Creighton was aroused from his slumbers a few mornings ago to issue an injunction against the Springfield Light, Heat & Power Company, restraining it from changing the machines used at the municipal plant, and also from severing extensions to poles in various parts of the city. The cause is set for hearing Sept. 1. Attorney James H. Graham, representing the city of Springfield, prepared the bill, which is directed against Emil J. Schmidt, general manager of the company, and his agents or representatives. The bill recites the agreement entered into between the city and the Springfield Light, Heat & Power Company, and charges the company with preparing to change lamps and extensions. It is also claimed that the dynamos at the company's plant at Tenth and Reynolds streets are being rewound, and that the old open arc lamps, which were taken down about three years ago, were to be placed in position, instead of the enclosed arcs which now are in use. The old lamps were taken down by the company without the consent of the city and have since been in storage. There are 394 lamps which the company claims are the property of the city. Since the lamps were changed, a number of extensions have been made and new lamps have been placed in position. The injunction proceedings recites that to allow the company to carry out the plans recently agreed upon, a portion of the city would be left in darkness.

Obituary.

MRS. E. FLEISCHMANN-ASCHHEIM.—Mrs. Elizabeth Fleishchmann-Aschheim the wife of I. J. Aschheim, grand secretary of the Independent Order B'nai B'rith, San Francisco, Cal., died August 3, after suffering for months from injuries sustained in the pursuit of her profession as a radiographer. For years Mrs. Aschheim had been operating with the X-ray, and had acquired fame as one of the best experts in that line. She became indispensable to the Army physicians during the Philippine war, when wounded and crippled soldiers landed on the transports, and she located the bullets and splinters and exposed them to the eyes of the surgeons. Her work attracted the attention of the Surgeon-General of the Army, who rated her work very highly. But so intent was she in the performance of her own work that she became careless of her own health, and thus she sacrificed her arm in the pursuit of that fame. The arm was amputated last January. She never fully recovered her health,: though she endured all suffering with heroic fortitude. Death came as relief. Mention of the noteworthy work of Mrs. Aschheim has frequently been made in the ELECTRICAL WORLD AND ENGINEER. Her most recent work was in perfecting a heavy plate-glass screen for use in radiographic demonstrations, but her invention was conceived too late, as the x-ray had already burned her arm badly and fatally.

Personal.

W. B. HALE.

MR. WILLIAM B. HALE, who has just assumed the duties of general manager of the Mexican Telephone & Telegraph Company, is one of the well-known electrical engineers of Chicago, having been president of the Chicago Electrical Association at the time of its union with the Western Society of Engineers, to become the Electrical Section, and having been since honored again by being elected chairman of the Electrical Section in recognition of his services. Mr. Hale is 37 years of age, and received his education at the University of Toronto and at the School of Practical Science in the same city, in which latter he took the course in electrical engineering. For a short time after graduation he was employed as assistant in the Meteorological Observatory at Toronto, and went to Chicago in 1889 to take a position with the Sperry Electric Mining Machine Company. In 1890, he entered the employment of the Western Electric Company and was soon promoted to various positions at the laboratory, and a little later was given complete charge of the company's laboratories and testing room. Many of the methods of testing employed in the plant have been devised by him. He has had large experience, both in the testing and installation of underground cables and has superintended their installation in many cities. Mr. Hale has been for many years a fluent speaker of Spanish, which, of course, will be indispensable to him in his new position. The company of which he has just become general manager is the Bell telephone organization of Mexico, having exchanges in all the principal cities of the republic. The electrical men of Chicago regret very much to lose such a member from their ranks, but unite in congratulations to Mr. Hale on the greater opportunities offered by his new position.

MR. J. G. WHITE, of J. G. White & Company, sailed for Europe Aug. 15 on the "Koenig Wilhelm II."

MR. JOSEPH A. HERBERT has been appointed manager of the Citizens' Telephone Company, Terre Haute, Ind., to succeed Mr. C. R. Duffin, resigned.

Dr. J. E. IVES has resigned from the De Forest Wireless Telegraph Company to accept the position of assistant professor of physics in the University of Cincinnati O.

MR. C. W. KOINER has been made manager of the National Lighting & Improvement Company, of St. Louis, which owns and operates various lighting, traction and other properties.

MR. H. R. KING was recently elected local secretary of the A. I. E. E., Chicago. Mr. King is now head of the engineering work of the Western Electric Company in Chicago, formerly in charge of H. H. Wait, resigned.

MR. H. F. CAMERON, of the Atlanta office of the Westinghouse Electric & Manufacturing Company, has been appointed to take charge of the New Orleans office of that company, with headquarters at 1110 Hibernia Bank building.

MR. HENRY NOEL POTTER, of Cooper Hewitt mercury arc and Nernst lamp fame, has been made a doctor of science by Amherst College in recognition of his valuable contributions to engineering and science. He has himself taken out nearly threescore patents.

MR. RALPH B. COLEMAN, formerly electrical engineer of the Case Threshing Machine Company, Racine, Wis., is now connected with the Western Electrical Company, of Omaha, Neb., as superintendent of the construction department, handling the sales of Northern Electrical Manufacturing Company's generators in that district.

MR. J. A. VAUGHAN, who for some time past has been sales manager of the Manhattan Electrical Supply Company, New York, has resigned to take charge of the Southern Electric Company, Baltimore, Md. Mr. Vaughan's extensive acquaintance and experience in the electrical field will insure his success in this southern trade.

MR. W. J. WARDER, JR., has been promoted from the engineering department of the Western Electric Company, of Chicago, to a much more important position in the engineering department of the New York office of that company. Mr. Warder was at one time secretary of the Chicago Electrical Association and is well known among Chicago electrical men.

MR. A. O. BENECKE announces that he has severed his connection with the Weston Electrical Instrument Company, with which he has been associated for the past 15 years as chief engineer, and that he has opened an office at 763 Broad Street, Newark, N. J., as an expert on electrical measurements, measuring instruments, testing outfits, standardizing laboratories for power plants and manufacturers, instruction of station attendants, etc., as to testing and repair of instruments.

DR. F. A. C. PERRINE, 49 Wall Street, New York, has decided to go extensively into isolated plant work, covering the general engineering and operating problems of electric lighting, power development and operation, thus affording to the small company or corporation the advantages of a well-equipped engineering office at a very moderate fee. Dr. Perrine is directly assisted in this work by Mr. Edwin H. Seaman, who will attend to the minor details thereof.

PROF. DR. W. WYSSLING, of Zurich, Switzerland, will arrive at New York, Aug. 21, on a visit during which he will make a study of some of the latest developments here in electrical engineering. Dr. Wyssling is professor of electrical engineering in the Polytechnicum of Zurich; director of the Sihl Electrical Generating plant, secretary of the Swiss Institute of Electrical Engineers and Secretary and member of the Government commission for the study of the electrification of the Swiss railways.

MR. F. B. H. PAYNE, formerly Expert Manager of the Westinghouse Electric & Manufacturing Company, has been elected vice-president and chief engineer of the Iroquois Construction Company, which is building the power plant of the Niagara, Lockport & Ontario Power Company, and of which General Francis V. Green is president.

MR. J. S. ANTHONY.—Mr. James Stowell Anthony, of the General Electric Company, was married to Miss Alys P. Scott, daughter of Mr. and Mrs. Alfred Bowne Scott on August 15. The wedding took place at Geneva, Switzerland, the ceremony being performed by the Rev. Percy Gordon, assisted by the Rev. Mr. Belden. Mr. and Mrs. Anthony will return to this country early in the fall and will reside in New York, where Mr. Anthony has charge of the affairs of the District. He has been for many years past connected with the electrical industry, and was assistant director of the U. S. department of machinery and electricity at the Paris Exposition of 1900.

MR. B. A. MAPLEDORAM the new general manager of the Northern Texas Traction Co., Fort Worth, Tex., has had a long connection with trolley work. From 1884 to 1896 he was with the Lorain Steel interests, and began to have charge of electric railway construction. He has built roads in Philadelphia, New York, Washington, Harrisburg, Lancaster and Chester, Pa. In 1899-1902 he built and operated the Suburban Rapid Transit of Pittsburg, and then built and organized the Mississippi Valley Traction Co.'s operating department. In 1905 he reconstructed the Memphis (Tenn.) system.

DR. LEE DE FOREST.—Lee DeForest, inventor of the DeForest system of wireless telegraphy, is at the Pensacola Navy Yard inspecting the plant there. He went to ascertain the trouble with the local system and why uninterrupted communication could not be maintained between Pensacola and Key West. The wireless station there was completed several months ago, but has never been operated successfully, especially with Key West, though messages have been exchanged with battleships far out at sea and with Gulf ports. It is expected that another mast, about 200 feet in height, will replace one of the present ones, and it is believed that this will remedy the difficulties now encountered.

MR. A. S. RICHEY, chief engineer of the Union Traction Company, Anderson, Ind., has been appointed assistant professor of railroad engineering at the Worcester Polytechnic Institute, Worcester, Mass. Mr. Richey got a degree in electrical engineering at Purdue University in 1894. After having been associated with the Citizens' Street Railway Company, at Muncie, Ind., and the Marion (Ind.) Street Railway, he became, in September, 1899, chief electrician of the Union Traction Company of Indiana. He became electrical engineer of the Indiana Union Traction Company when it absorbed the other company in 1903 and remained as such until July 1, 1905, when he became chief engineer of the company's system of 400 miles of track. Mr. Richey was born in Muncie, Ind., April 10, 1874.

MR. W. W. WHEATLY, president and general manager of the Federal District Railway, and managing director of the Mexican Traction Company, of Mexico City, Mex., was given a banquet by Sir Charles Euan-Smith, the chairman of the board of directors of the company, at the Chapultepec restaurant, Mexico City, on Monday, Aug. 7. There were present as guests some 47 persons, among whom were many leading government officials, representatives of the diplomatic corps and leading business men and bankers. Especially prominent among those present were the son of President Diaz and the President's Military Chief of Staff. Sir Charles complimented Mr. Wheatly highly on his efficient management of the street railway lines. Mr. Wheatly expects to be in New York during October to remain several weeks, during which time he will contract for considerable sub-station machinery.

MR. WALTER E. HARRINGTON has resigned as vice-president and general manager of the New York-Philadelphia Company to become associated with the J. G. White Company of New York as operating manager. In this capacity he will supervise all of the railway, electric lighting, gas and other properties operated by the company. Mr. Harrington is a graduate of the University of Pennsylvania, and since 1887 has been principally engaged in electric railway work. He has been electrical engineer for the Pennsylvania Railroad Company in charge of the electric railway at Atlantic City, N. J., general superintendent of the Wheeling Traction Company and the Citizens' Railway Company, of Wheeling, W. Va., supervising electric railway engineer for the General Electric Company in the Northern Pennsylvania coal regions, and for some years general manager and vice-president of the Camden & Suburban Railway Company, Camden, N. J. After the latter was absorbed by the Public Service Corporation, he was placed in charge of all the properties of the latter south of Trenton, N. J. Mr. Harrington has also acted as consulting engineer for a number of railway systems, supervising the change from horse to electric power.

MR. CHARLES S. BRADLEY has taken into partnership his two sons and opened an office at 41 Park Row for the practice of consulting engineering. Mr. Bradley's work in the electrical field is so well known that it is needless to refer to it in detail. As an inventor of single-phase and polyphase apparatus, of the process now used for the production of aluminum and of the rotary furnace for the production of calcium carbide, he has been a leader in the electrical field for the past twenty years and his name will always occupy a conspicuous place in the history of the art. His elder son, Mr. Alonzo B. Bradley, was graduated from Columbia University in 1903 with the degree of electrical engineer. Since then he has been with the General Electric Company in its Schenectady shops, and has taken part in establishing one of the electro-chemical processes at Niagara Falls. The younger son, Mr. Walter E. F. Bradley, was graduated from Columbia University the present year as an electrical engineer. While at the university he was manager of the University boat crew, president of the University Electrical Engineering Society and president of the Senior Class of the School of Mines. The firm will design and supervise the construction of

isolated lighting and power plants, central station, railway and gas engine plants and electro-chemical plants, as well as report on inventions and undertake the perfection of electrical, mechanical and chemical devices and processes.

MR. J. C. PATRICK has been appointed superintendent of the new plant of the Marquette County (Mich.) Gas, Light & Traction Company.

MR. GEO. HORNUNG, of Cincinnati, O., has been engaged to design an entire new electric light plant for Reading, O., to take the place of the present old plant. New boilers, engines, generators, street lamps and line work will be required.

MR. T. N. McCARTER.—Mr. Thomas N. McCarter, president of the Public Service Corporation, of New Jersey, has had plans drawn for a mansion to cost $100,000, to be erected on his estate on the Rumson Road, at Seabright. N. J. The house will have forty rooms, with a telephone in each.

MR. S. INSULL.—A special dispatch from Chicago of August 9, says: "A report from London that Samuel Insull of this city, president of the Chicago Edison Company, would make his permanent home in the British metropolis, was denied emphatically in a cablegram from Mr. Insull to-day, to William A. Fox, secretary and treasurer of the Edison company. The report from London also said Mr. Insull had had private assurance that the enabling act now before parliament would pass. This gives authority for the building of an immense plant to generate and distribute electric power throughout the metropolitan district of London."

MR. G. L. GROVER vice-president and general manager of the Eastern Wisconsin Railway & Light Company, operating the local street railway in Fond du Lac, Wis., the Fond du Lac interurban line and the Fond du Lac electric and gas plant, has handed in his resignation, to take effect Oct. 1. He has been identified with the Fond du Lac company for nine years, going to that city in 1896 from Milwaukee, where he was superintendent of the Milwaukee & Wauwatosa Electric Company. In 1903, when the Eastern Wisconsin Railway & Light Company was organized, he was elected general manager. Mr. Grover was president of the Northwestern Electrical Association in 1904, and is a thorough electric light man, an "Edison man," in fact, having been connected with the old Edison Electric Mfg. Company at "Sixty-five," away back in 1885-6, when he did considerable construction work. Mr. Grover, who is a Jersey man by birth, has been visiting in Newark this month.

MR. HALBERT P. GILLETTE, M. Am. Soc. C. E., M. Am. Inst. M. E., formerly associate editor of *Engineering News*, and Mr. Geo. H. Gibson, A. M. Am. Inst. E. E., J. M. Am. Soc. M. E., formerly manger of publicity for the International Steam Pump Co., manager of the advertising department of the B. F. Sturtevant Co., and editor of the Westinghouse Companies' Publishing Department, have formed a partnership as "advertising engineers," under the name of Geo. H. Gibson Company, with offices in the Park Row Building, New York City. They undertake to conduct a firm's advertising in the same manner as would a department in the firm's own offices, and are not advertising agents in the usual sense of the term, as they receive no commissions, rendering only service and leaving the actual purchasing of space and printed matter in the client's hands. In an interesting circular announcing its new departure, the firm says: "Products of scientific manufacture require promotion even more than do commercial articles of general consumption. The engineer or manufacturer who has spent years of work and thought upon the perfection of a new product or machine accepts as axiomatic that, because there is a need for it, there will be a demand. He forgets that before his possible customers will give up their accustomed and familiar methods to adopt the new, they must to some degree pass over the same mental course that he has traversed, and, unless educational measures are adopted, this is apt to be a matter of many years. To introduce his improvements in steam engine valve gears, Corliss was forced practically to giving his machines away. The Parsons steam turbine was an engineering success ten or twelve years before it became a commercial success in this country. On the other hand, the turbine centrifugal pump, by modern advertising methods, has been made commercially successful in a period of two years, the sales of the third year being four times those of the first, while a prominent cordage manufacturer has increased the sales of his transmission rope twenty times over within a few years by means of advertising."

Trade Publications.

"A B C" DISC FANS.—A very attractive little pamphlet has just been issued by the American Blower Company, Detroit, Mich., in which are given illustrations of "A B C" disc fans of various sizes for a variety of uses. Accompanying each illustration are a few words of descriptive matter. Some of the fans are driven by electric motors. A price-list and telegraphic code are also given.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, of Plainville, Conn., has recently issued a supplement of its No. 5 catalogue, listing its Type A switches up to 1,200 amperes. Especial attention is given to aligning the blades and jaws. After being perfectly adjusted, the blades are ground into the jaws with fine emery, to insure the smoothest contact surfaces. This adjusting is so accurate that these switches, it is stated, will continuously carry, without heating, a considerable overload.

News of the Trade.

TOLEDO STORAGE BATTERY COMPANY.—Mr. L. B. Humiston has, it is said, purchased a controlling interest in the Toledo Storage Battery Company. At the annual meeting of the stockholders the following named officers were elected: President, C. E. B. Lamson; vice-president, C. A. Byers; secretary, treasurer and general manager, L. B. Hamilton. The company intends to make some improvements to its plant in Toledo.

EQUIPMENT FOR APARTMENT HOUSE.—A 12-story apartment house is to be built on Amsterdam Avenue from 72nd to 73rd Streets, New York, which will have a complete steam, electric and refrigerating plant. The Central Realty Company, of 900 Seventh Avenue, is the owner; Messrs. Mulliken & Moeller, architects, and Percival Robert Moses, E. E., 320 Fifth Avenue, has been retained as consulting engineer. There will be practically two separate plants, consisting of two boilers of 125 horse-power capacity in each building. The engines will be three simple automatic high-speed horizontal type. Two will be 11 in. x 10 in., and one 10 in. x 10 in. They will operate at about 300 r.p.m. The generators will be direct-current, 115-volt, compound-wound multipolar, two of 40 and one of 30 kilowatts capacity. There will also be an extensive storage battery and refrigerating system.

HYDRAULIC JACKS.—Unless a hydraulic jack is absolutely reliable, its use had best be avoided. Just at the critical moment, when everything depends on a jack "standing up," a poorly made device is liable to give way, with consequences best left to the imagination; they are not pleasant, even to imagine. In the Watson-Stillman hydraulic jacks, it is claimed that every element of uncertainty is eliminated. The cylinders and rams, for which, in some makes, so-called seamless tubing is thought good enough, are in the Watson-Stillman jacks forged from solid steel billets and bored like the cylinder of a high-class steam engine. Valves, glands, pistons, etc., are made and finished with equal care, packings and other parts subject to wear are easily accessible and replaceable, the result being a hydraulic jack thoroughly dependable and constantly ready for service. The manufacturer, Watson-Stillman Company, 46 Dey Street, New York, makes a line of about 300 styles of hydraulic jacks.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED AUGUST 8, 1905.
[Conducted by Rosenbaum & Stockbridge, Patent Attys., 140 Nassau St., N. Y.]

796,435. SECONDARY BATTERY; Jacobus Langelaan, Oberschoneweide, near Berlin, Germany. App. filed Feb. 27, 1905.

796,437. DOOR SECURING MEANS; Libermond A. Leon, Montreal, Can. App. filed Aug. 4, 1904. A construction of a door latch in which an electro-magnet is effective to release a hammer which falls by gravity and permits opening the door. The hammer is re-set by a connection from the door knob. Additional means permit the door to be opened by a key.

796,441. TELEPHONE SYSTEM; Kempster B. Miller, Chicago, Ill. App. filed Feb. 4, 1901.

796,464. CAR BRAKE; Charles J. Specht and Charles R. Krueger, New York, N. Y. App. filed June 24, 1904. The usual pivoted brake shoe has a pair of electromagnets embedded in its face with sectional windings thereon which can be successively cut into or out of circuit so as to vary the braking action.

796,467. ELECTRIC ARC LAMP; Bernard A. Stowe, Cleveland, O. App. filed Dec. 5, 1902. A construction of arc lamp having a central tube or "back-bone" with a U-shaped spring plate embracing the same and regulator magnets suspended from the free ends of said spring plate. The lamp is arranged so that coils for constant current, constant potential, or alternating potential, can be substituted for one another in the device.

796,474. MOTOR CONTROL SYSTEM AND SWITCH THEREFOR; Leonard A. Tirrill, Lynn, Mass. App. filed Apr. 15, 1903. A device for stopping a motor after a pre-determined amount of work has been done. An auxiliary motor in series with the armature circuit winds up a cord which throws the main switch after a pre-determined movement.

796,483. FEED REGULATING DEVICE FOR ELECTRIC MOTORS; Seward W. Williams, Lapeer, Mich. App. filed June 1, 1903. In order to prevent a controller being manipulated to cut out the starting resistance too suddenly, the controller arm carries a ratchet and pawl arrangement which allows the starting resistance to be cut out only by a step-by-step movement. The controller can be returned by a single movement. An emergency connection is made to the reverse switch by which the latter can be moved three points at once under certain circumstances.

796,501. CONDUCTOR RAIL HOLDER FOR ELECTRIC RAILWAYS; George L. Courtney, New York, N. Y. App. filed Feb. 14, 1905. A third-rail support comprising a massive block of cement which has an iron base plate embedded in it by which it is secured to the ties. The cement block has a petticoat flange formed thereon to secure more efficient insulation.

796,512. EXTENSION CIRCUIT CLOSER; Jacob R. Hershey, Keokuk, Ia. App. filed Dec. 7, 1901. An alarm circuit is closed by the vibration of the usual hammer of a telephone bell, which vibrates against a trip lever and releases a spring blade which closes the local alarm circuit.

796,517. BATTERY HOLDER FOR AUTOMOBILES; Frank Jackson, Denver, Col. App. filed Sept. 27, 1904. A casing having four rectangular pockets with spring clips at the bottom to embrace the usual zinc casing of a dry battery, and additional spring clips at the top of each pocket to embrace the carbon elements.

796,533. ELECTRIC BATH ROBE; Edwin B. Rayner, Piqua, O. App. filed Oct. 2, 1902. The bathrobe is lined with small heat-coils which not only serve to warm the wearer of the robe, but also constitute electrodes for electric treatment.

796,550. LIGHTNING PROTECTOR FOR BUILDINGS; John P. A. Anderson, Madrid, Ia. App. filed Sept. 20, 1904. In order to avoid expensive lightning conductors, the patentee makes use of the usual gutters and metallic fittings of a frame house. A special cap is placed upon the chimney.

796,555. APPARATUS FOR DISTRIBUTING ALTERNATING CURRENTS; Arthur F. Berry, Ealing, England. App. filed Nov. 6, 1903. When the current falls below a predetermined amount, a magnet is sufficiently de-energized to cut in a supplemental transformer, so as to bring its primary and secondary coils into series with the primary and secondary windings of the main transformer. When the current exceeds a certain amount, the supplemental transformer is short-circuited so that the main transformer is alone in action.

796,559. ELECTRIC SIGN; Charles T. Bradshaw, Philadelphia, Pa. App. filed Mar. 17, 1902. A display apparatus in which a circular box has illuminated letters on its front face and rotates on a diametrical axis at high speed, so that the illuminated letters appear to be floating in space.

796,562. TELEPHONE CALL MECHANISM; Tracy R. Campbell, Aberdeen, S. D. App. filed Jan. 14, 1905.

796,568. TELEPHONE SYSTEM; William W. Dean, Chicago, Ill. App. filed Oct. 27, 1902.

796,595. TELEGRAPHIC TRANSMITTER; Alexander Muirhead, Shortlands, England. App. filed Apr. 27, 1899. A relay for cable telegraph systems in which a transmitter is operated by the line current and sends local currents of varying intensity corresponding to the line current through a vibrating relay coil. The relay coil makes a succession of dots of positive or negative character according to the polarity and duration of the line current.

796,596. ELECTRIC TELEGRAPHY; Alexander Muirhead, Shortlands, England. App. filed Oct. 14, 1901. Relates to modifications of the above in which a vibrating relay coil is connected in a specially arranged circuit, including a condenser. By virtue of the arrangement the received wave is retransformed into its original characteristic of a pulsating current.

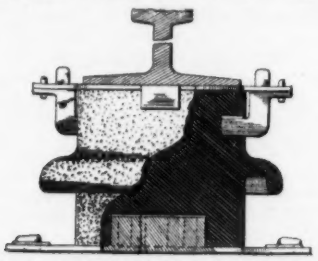
796,597. TELEGRAPHIC RECEIVER. Alexander Muirhead, Shortlands, England. App. filed Dec. 13, 1901. Line current is led through a wire under tension which is constantly vibrated. The wire also has a lateral movement by virtue of a suspended coil which carries the line current, and this lateral movement is effective to make positive or negative local circuit contacts.

796,606. ELECTROMECHANICAL REGULATOR; Joseph L. Routin, Lyon, France. App. filed July 17, 1901. The same arm which varies the resistance in the generator-field circuit, is effective to vary the power of the prime mover. A ratchet-wheel connection from the main power shaft is employed to move the regulator arm under the influence of magnets controlled by the potential.

796,607. DEVICE FOR APPLYING STERLIZERS TO MOUTHPIECES; Orrin H. Savage, New York, N. Y. App. filed Sept. 1, 1903.

796,637. COMBINED ELECTRIC MOTOR, RHEOSTAT AND BELT TIGHTENER. Herman S. Graber, St. Louis, Mo. App. filed Dec. 8, 1904. A driving apparatus for a printing machine or the like in which the rheostat arm has an attachment which operates a belt tightener.

796,646. TIME-LIMIT CIRCUIT CONTROLLER; Edward M. Hewlett, Schenectady, N. Y. App. filed May 12, 1903. The solenoid which actuates the usual circuit breaker has a connection with a diaphragm of an air chamber. The air is allowed to escape very slowly from the chamber, which prevents the circuit breaker from acting immediately.



796,501.—Conductor-Rail Holder for Electric Railways.

796,684. ELECTRIC HEATER; Elihu Thomson, Swampscott, Mass. App. filed Jan. 13, 1905. (See Current News and Notes.)

796,687. CIRCUIT CONTROLLER. Howard B. Wilson, Schenectady, N. Y. App. filed Apr. 18, 1903. The final break of a motor controller is made by contacts in an oil bath which are actuated by a tappet. An additional feature is the heating of the oil bath under excessive current to raise a piston and break the circuit.

796,697. TROLLEY CATCHER; Seth J. Buckland, Springfield, Mass. App. filed Jan. 30, 1905. The returning spring is held normally ineffective by a laterally moving spring pressed bolt. Under excessive speed of the trolley reel certain arms fly outward and release the bolt, which permits the returning spring to act.

796,701. ELECTRIC CLOCK; Ragnar Carlstedt, Jersey City, N. J. App. filed Sept. 1, 1904. The special feature relates to the operating magnet which is concealed in vertical columns which support the clock mechanism. An armature oscillates between the columns and winds up the main spring.

796,702. POLE PIECE; Alexander Churchward, New York, N. Y. App. filed Oct. 25, 1902. The pole pieces are arranged with lateral triangular holes which are designed to render the intensity of the field uniform across the pole piece whether or not the generator is under over-load conditions.

796,728. RAILWAY SIGNALING DEVICE; Joseph Irwin, St. Louis, Mo. App. filed Sept. 13, 1902. In order to show when a locomotive is entering a block section a local circuit on a train is provided, which includes different sets of wheels on the train sufficiently spaced apart so as to lap over the insulated joint and temporarily open the local circuit to give an alarm.

796,749. ELECTRIC CAR LIGHTING; James F. McElroy, Albany, N. Y. App. filed Oct. 6, 1902. A dynamo which is direct connected to the wheels of a car, has a mechanical attachment by which it is only connected to the storage batteries when its speed is sufficiently high, and has a mechanical pole changer to adjust the dynamo to the direction of movement of the car.

796,753. MACHINE FOR TREATING ORES; John R. Parks, Spokane, Wash. App. filed Aug. 20, 1903.

796,754. PROCESS OF TREATING ORES; John R. Parks, Spokane, Wash. App. filed Aug. 20, 1903.

796,757. ELECTRIC INCANDESCENT LAMP; William J. Phelps, Detroit, Mich. App. filed Apr. 25, 1902. Relates to that type of lamp in which the main filament can be extinguished, but a small one-candle-power filament left glowing. In this patent the lamp is adapted to a Thomson-Houston socket.

796,760. LIGHTNING CONDUCTOR; Frank E. Price and William H. McCullough, River Forst, Ill. App. filed Mar. 6, 1905. A construction of lightning conducor having a cluster of points made of copper, the body of which is plated with gold, while the points are plated with platinum.

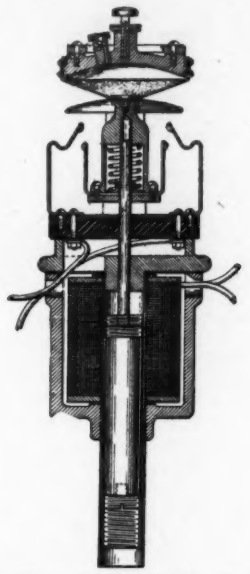
796,797. CLAMP FOR ATTACHING GROUND WIRES; George R. Blackburn, Cleveland, O. App. filed Oct. 21, 1904. A fixture for bell hanger's use adapted to provide a ready means of grounding wires on gas pipes, etc. An iron strap has a screw for tightening it upon the pipe.

796,800. RECEIVER FOR USE IN WIRELESS TELEGRAPHY; Edouard Branly, Paris, France. App. filed Sept. 4, 1902. (See Current News and Notes.)

796,817. TROLLEY APPLIANCE; Frank P. Criner, Fort Wayne, Ind. App. filed Dec. 19, 1904. In order to prevent the trolley wheel from so great a tendency to jump the wire, its harp is supported by parallel rods which always hold it in a vertical relation.

796,821. SWITCHBOARD FOR METER TESTS; Russell A. Dangler, New York, N. Y. App. filed Dec. 9, 1904. A portable meter testing set having terminal connections with clips which can be inserted into openings in the meter to make the necessary contacts therein.

796,851. RUHMKORFF COIL; John McIntyre, Jersey City, N. J. App. filed Dec. 3, 1904. A contact for induction coils which does not change its angular relation when adjusted. The contact rod is square and slides into its various positions of adjustment.



796,646.—Time Limit Circuit Controller.

796,853. COMBINED FIXTURE SUPPORT AND CANOPY; William H. Nichols, Bennington, Vt. App. filed Jan. 9, 1904. A canopy particularly designed for supporting electric chandeliers in which the interior faces of the canopy have a pair of porcelain blocks upon which the necessary connections are made.

796,867. SYNCHRONIZING SYSTEM; Paul Ribbe, Halensee, near Berlin, Germany. App. filed Dec. 16, 1904.

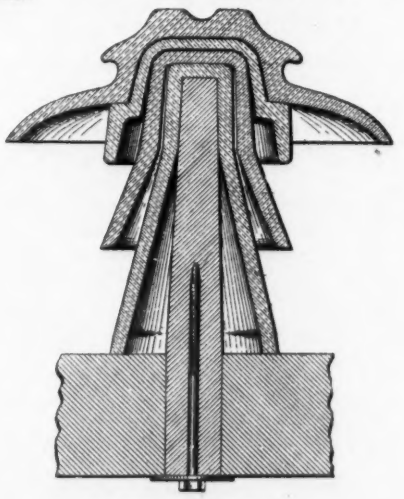
796,869. TROLLEY WHEEL; John C. A. Riecke, Baltimore, Md. App. filed Jan. 14, 1905. A pair of arms project upwardly from the trolley harp and are arranged to rock rearwardly in passing the usual supporting wires.

796,872. ELECTROPLATING DEVICE; Henry Schuessler, Peru, Ill. App. filed Sept. 17, 1904.

796,904. THERMOSTATIC CIRCUIT CONTROLLER; Henry A. Fiske, Newton, Mass. App. filed Nov. 16, 1903. The thermostat plug has a chamber into which the molten metal will drop to close an alarm circuit.

796,922. ELECTRIC LIGHT FIXTURE. Robert W. Morgan, Yonkers, N. Y. App. filed Mar. 9, 1905. An electric lamp socket adapted for either Edison or Westinghouse lamps. A threaded bushing adapted for Edison lamps is held in place by the engagement of a crown of spring clips.

796,935. ELECTRIC CURRENT GOVERNOR; Henry K. Sandell, Chicago, Ill. App. filed Dec. 21, 1904. The governor is designed to cut in resistance into the circuit under excessive speed of rotation, and for this purpose a governor controlled contact moves out of range of a fixed brush when the speed increases, so as to open the circuit at this point and cut in the resistance.



796,977.—Insulator Pin.

796,944. HEATER; Harry S. Stewart and Margaret A. Wilcox, Chicago, Ill. App. filed Dec. 19, 1903. A feed water heater in which heating coils are enclosed within the feed-water chamber.

796,972. RAIL BOND; Edward B. Hunter, French Village, Ill. App. filed Dec. 15, 1903. A rail bond in which the bushings having the connecting bond are expanded into the rail by conical wedges with nuts upon their small ends.

796,977. INSULATOR PIN; Fred M. Locke, Victor, N. Y. App. filed Sept. 25, 1902. In order to promote the strength and insulation of the high potential insulator, the usual petticoats are carried by a conical sleeve upon the central pin which abuts against the woodwork.